United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

BRIEF FOR APPELLANT

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FOR THE DISTRICT OF COLUMBIA

No. 8716

ALVIN M. MARKS,

Appellant,

vs.

CONWAY P. COE, Commissioner of Patents,

Appellee.

On Appeal from Judgment of the District Court of the United States for the District of Columbia

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Statement

This is an appeal from the judgment of the District Court of the United States dismissing appellant's bill of complaint under R. S. 4915 seeking to have that Court find that the plaintiff-appellant is entitled to have issued to him a patent corresponding to his patent application Serial No. 240,608 relating to a method and device for producing polarized illumination. The claims of said patent application which are involved are claims 1, 3, 65 and 68, the remaining claims, relating to various other features of appellant's invention, being allowed by the Patent Office.

The appellant, Alvin M. Marks, although he is now serving as a U. S. Naval Officer (USNR) doing technical work in connection with radar, has previously devoted substantially his entire time and effort to the development of the field of the polarization of light.

During his university work he specialized in optics, chemistry, physics and light and both during his university work and for the fourteen years thereafter, he has worked in the development and improvement of polarized light devices. For most of that period of time a small company operated under a license from him in the manufacture and sale of polarized material and devices, and this commercial development made possible his continuous research work in this field.

Appellant is the modern "garret" type of scientist who has had the added advantages of an extended and competent scientific education and the facilities of a laboratory set up by him as moneys were made from the sale of the polarizing materials which he developed.

The inventor here had no large staff of assistants nor endless funds for step-by-step research. He therefore struck out along entirely new and unexplored lines to solve the problem before him. His only tools were a thorough knowledge of the pertinent sciences of optics and physics and the sources of light and polarizing means available to all.

If this Court finds that the appellant has made a material contribution to the arts and sciences, as we shall try to demonstrate, then it has the opportunity to reward the individual inventor so that he can benefit from that contribution to the public good.

The invention involved here deals with a problem that has confronted scientists for a very long time. The problem is to subdue effectively the surface glare of ordinary light, and thereby reduce eye fatigue and improve visibility. The variety of ineffective devices to avoid glare evidences the acuteness and recognition of the problems of glare. These devices include frosted light shields, color filters, shades, and various other elements which reduce or seek to minimize glare. None of these, however, actually eliminates the glare component of light.

The phenomenon known as glare is produced either by the direct impingement on the eye of the original raw source of light such as sunlight or electric light or by the indirect impingement of such light reflected from a shiny surface. Such indirect or reflected glare is most common since the eye ordinarily views illuminated objects such as printed pages, table tops, floors, etc., and not direct sources of illumination such as incandescent bulbs.

The only practical glare reducing devices hitherto known have been the frosted light globes and color filters commonly employed. As stated above, these devices merely diffuse light and in no way eliminate the unnecessary and interfering glare light so that only the useful non-glare light is employed.

There have been various attempts which are well represented in the prior art cited by the Patent Office to eliminate glare by means of *polarizers* and the four references of record fully and competently show these previous attempts. None of these attempts to employ polarization to avoid glare have been successful, however, because they were and are impractical. They have been impractical because in every case it was necessary that the reader wear polarized spectacles to cut out the undesired surface glare component and allow only the diffused light which carries the visual detail to come through to his eye.

All of these previous attempts to employ polarization to avoid glare are substantially the same in principle. In each case the glare light is polarized so that it can be blocked out by a polarizer (called an analyzer when positioned in front of the eye) which is used as a spectacle.

The present invention relates to an apparatus and method for providing glare-free illumination by means of which objects, such as printed pages, pictures, etc., may be illuminated with only the useful desirable diffused (non-glare) light that illuminates the inner detail of such pictures or pages.

The present invention does not result from the natural development of the science of optics, nor from the perfection of synthetic polarizers. It constitutes a recognition and application of certain scientific principles which have been known for many years in the science of optics and polarization, but never before combined or used in any way approaching the present invention, and certainly never used before to provide non-glare illumination.

That is, the only elements necessary for avoiding glare according to this invention are an ordinary light source such as an electric bulb, a reflector such as the ordinary lamp reflector, and a polarizer (for this purpose, any of the polarizers known for a hundred years could be employed) all of which have been available for many years.

Despite this availability, no scientist has ever before combined these elements as has appellant here to produce this new and extremely useful result, notwithstanding the extreme necessity for a solution of this problem, and the many other previous unsuccessful attempts at a solution thereof.

The prior art, appellant's invention, and the references will be illustrated and briefly explained now by drawings and explanations that have not been factually challenged either in the Patent Office or in the Court below.

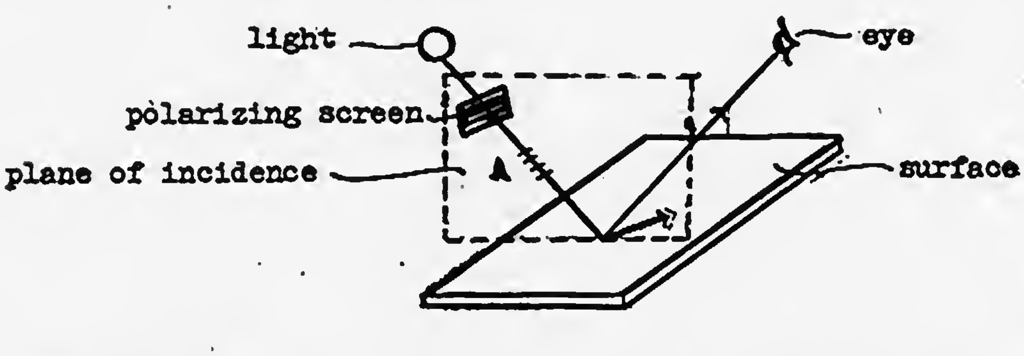
Definitions

"Polarizing" means the elimination from a beam of light of all vibrations except the vibrations in predetermined directions. A polarizer is an element, generally a crystal, having the peculiar property of selectively transmitting only a part of the light impinged thereon. It may be regarded as physically analogous to a picket fence. A beam of light which is vibrating in all directions, strikes this picket fence. Only the vibrations moving in directions parallel to the openings in the fence get through.

"Plane polarizing" means eliminating all vibrations of the beam of light except vibrations in given parallel planes.

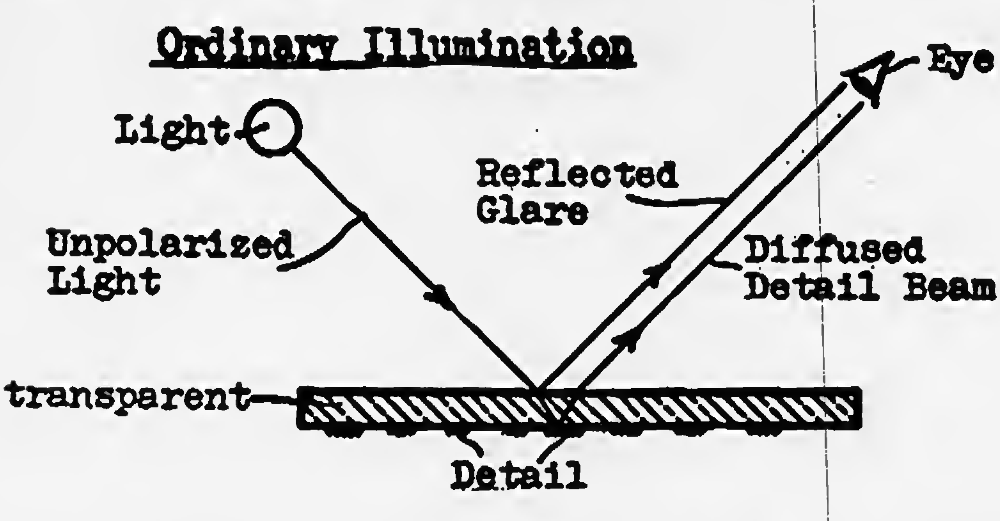
"Plane of incidence" means that plane, normal (at right angles) to a surface, which includes the light source, a light ray from the light source, and the point of impingement of the light ray upon the surface.

"Plane polarizing the light in a plane normal to the plane of incidence of the light" means all light vibrations are screened out (eliminated) except those polarized in this specified direction relative to the surface being illuminated by the light. The terminology employed is necessary because it must describe both the illumination of pictures on a vertical wall and also pictures on a horizontal table. In the following drawing the "plane of polarization" is represented by lines *A* at right angles to the plane of incidence.



"Reflected glare component"—Ordinarily, a picture has a glossy top surface consisting of a thin layer of some transparent substance such as varnish. Beaneath this varnish is the detail of the picture. Practically all surfaces have this reflecting outer layer to varying degrees. When a ray of light strikes the glossy, transparent surface layer, one portion of the light is reflected directly from the transparent surface layer to the eye of the observer. This portion of the light, directly reflected, mirror-like, in practically unvarying amounts from nearly all over the surface, is the undesired glare component. In this brief it is called the "reflected glare component".

The remaining portion of the light enters into the transparent layer and is diffused. This diffused light (the desirable or useful component) is then reflected in varying amount by the detail to the eye of the observer as diffused visual detail beam, as it will be hereinafter called. This is illustrated in the following diagram:



The second beam, being diffused light containing the visible detail, is free from any glare and gives the desired illumination of the detail of the substance, e.g., the various areas of pigment forming the picture or printing being viewed.

The first beam, the surface reflected glare component light is made up entirely of objectionable glare and acts only to obscure the second beam which is the useful light carrying the illuminated details.

Thus it can be seen that in ordinariy illumination when the eye views a surface in which lies detail as in the case of the ordinary glossy printed page, a mixture of light travels to the eye. A portion of that mixture is the diffused useful beam that illuminates the detail within the surface and the remainder of the mixture is reflected surface glare, i.e., simply light reflected mirror-like from the top of the shiny surface. The reflected glare interferes with and diminishes perception by the eye of the diffused detail beam.

Appellant's Invention

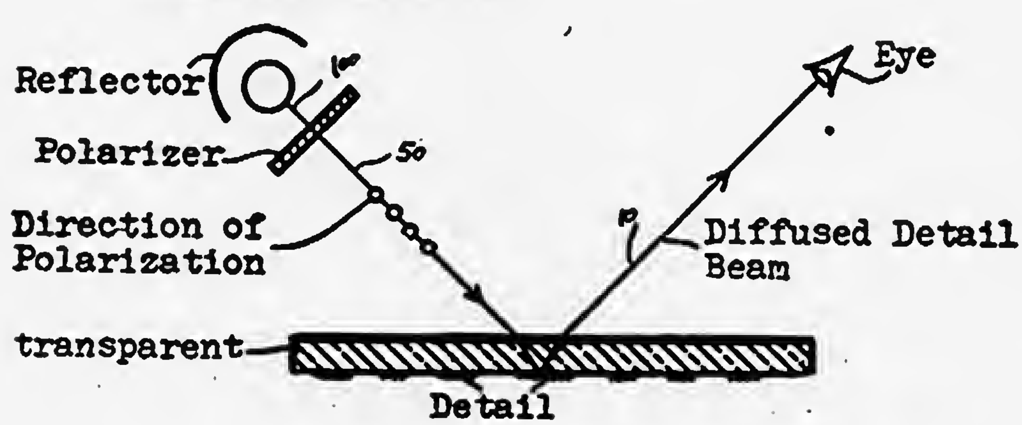
Appellant's invention resides in (1) the complete elimination of this reflected glare component light while (2) causing the remainder of the light to enter the surface and be converted to the useful diffused visual detail beam.

The elimination of the reflected glare component while leaving the diffused component unimpaired is accomplished by appellant by the following steps.

(1) All light from the source is directed toward the surface to be viewed at a critical angular range of from twenty to seventy degrees to the surface and preferably at an angle of thirty-three degrees thereto.

(2) Before striking the viewed surface, this light is plane polarized in a specific manner, i.e., polarized in a plane normal to the plane of incidence of the light as illustrated in the following:

Present Invention



As a result of these two steps which are set forth in all the claims, the light from the source is so plane polarized and so directed that the only light reflected from the viewed object is the internally reflected useful diffused visual detail component of the light. This is due to the fact that when light which is plane polarized in the plane specified strikes the transparent layer at an angle of twenty degrees to seventy degrees, there is substantially no light reflected from the surface, i.e., there is no surface reflected glare component. The only light reflected from the substance is the desirable diffused non-glare light reflected internally from the detail.

Thus, as a result of (1) plane polarizing the light in the specific plane set forth and (2) directing the light upon the object at the critical angle of from twenty degrees to seventy degrees to the normal, the reflected glare component is substantially or completely eliminated and the remainder of the light which strikes the surface of the viewed surface is of such a nature that it wholly enters into the transparent substance, and is diffused and then reflected carrying visual detail illumination to the observer.

Or, in other words, the result obtained is the selective elimination by the steps set forth of substantially all of the undesired surface reflected glare component of the light while permitting light capable of being refracted and wholly diffused to enter into the surface being illuminated. Thereafter this light is diffused and reflected toward the observer carrying only visual detail.

The claims in issue read as follows:

> 1. The method of viewing a light refractive object having areas of different reflectivity by omitting the glare effect which comprises transmitting a beam of light to the light refractive object along an axis of substantially between twenty and seventy degrees to the normal to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam

upon said light refractive object, thus substantially eliminating the reflective glare component of the beam; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and diffusedly reflecting the light from said light refractive object to the objective with no polarizing medium between the object and the point of observation.

3. The herein described method of providing glare-free illumination of a light refractive object having areas of different reflectivity which comprises transmitting a beam of light to the light refractive object along an axis of substantially thirty-three degrees to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam upon said light refractive object, thus substantially eliminating the reflective glare component of the beam; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and diffusedly reflecting the light from said light refractive object to the objective with no polarizing medium between the object and the point of observation.

65. A lighting device adapted to provide glare-free illumination for a viewing surface of an object having areas of different reflectivity comprising a light source, polarizing means, a reflector adapted to reflect light from said light source onto said polarizing means, said polarizing means being positioned to plane polarize the reflected light from said lighting device in planes substantially normal to the planes of incidence of said light upon the viewing surface, said reflecting means further directing said light through said polarizing means onto said viewing surface at an angle of about thirty-three degrees to the surface.

68. In a device for illuminating a body surface portion having an exterior light refractive layer, a light source located at a distance from said body surface portion; means for directing light rays from said light

> source onto said body surface portion at an angle in the range from twenty degrees to seventy degrees to said body surface portion; and a light polarizing layer extending across the path of said light rays so that substantially all usable light rays reaching said body surface portion from said light source pass through said polarizing layer, said polarizing layer being so shaped and so axially positioned relatively to the direction of the light rays, that substantially all light transmitted through said polarizing layer toward said body surface portion is plane polarized in planes normal to the planes of incidence of said light rays upon said body surface and thereby substantially eliminating the reflection from the uppermost surface of said refractive layer of light rays transmitted to said body surface portion from said light source.

The method claims 1 and 3 recite, in addition to the other necessary steps of the process, the two critical steps (1) and (2) above set forth.

The article claims 65 and 68 recite the necessary structure for this particular non-glare illumination device and particularly set forth (1) the correlation and positioning of the polarizer to effect the necessary and critical polarization, and (2) the means for directing light on to the surface to be viewed at the proper and necessary angle.

The Patent Office and the Court below have never challenged the fact that these claims properly and accurately define appellant's process and apparatus. This is not an issue here.

Never before in this art has any glare-free illumination method been suggested that eliminates the glare component first and thus avoids the necessity for an analyzing eyepiece.

The Patent Office agrees that every one of the references cited polarizes and analyzes the light to eliminate glare.

Appellant does not use a polarizer and analyzer and does not first polarize and then analyze the light. This fact is also set out in the uncontradicted affidavit of the expert

Pickard (Tr. p. 38), and appellant hereby recites that he relies in part for the patentability of the claims over the references upon the fact that his system does not employ a polarizer and analyzer and does not polarize and analyze light.

That is, appellant employs a single selective polarization with no further polarization or analyzation of the light.

Four references have been relied upon in the rejection of the claims. They are as follows:

Preston

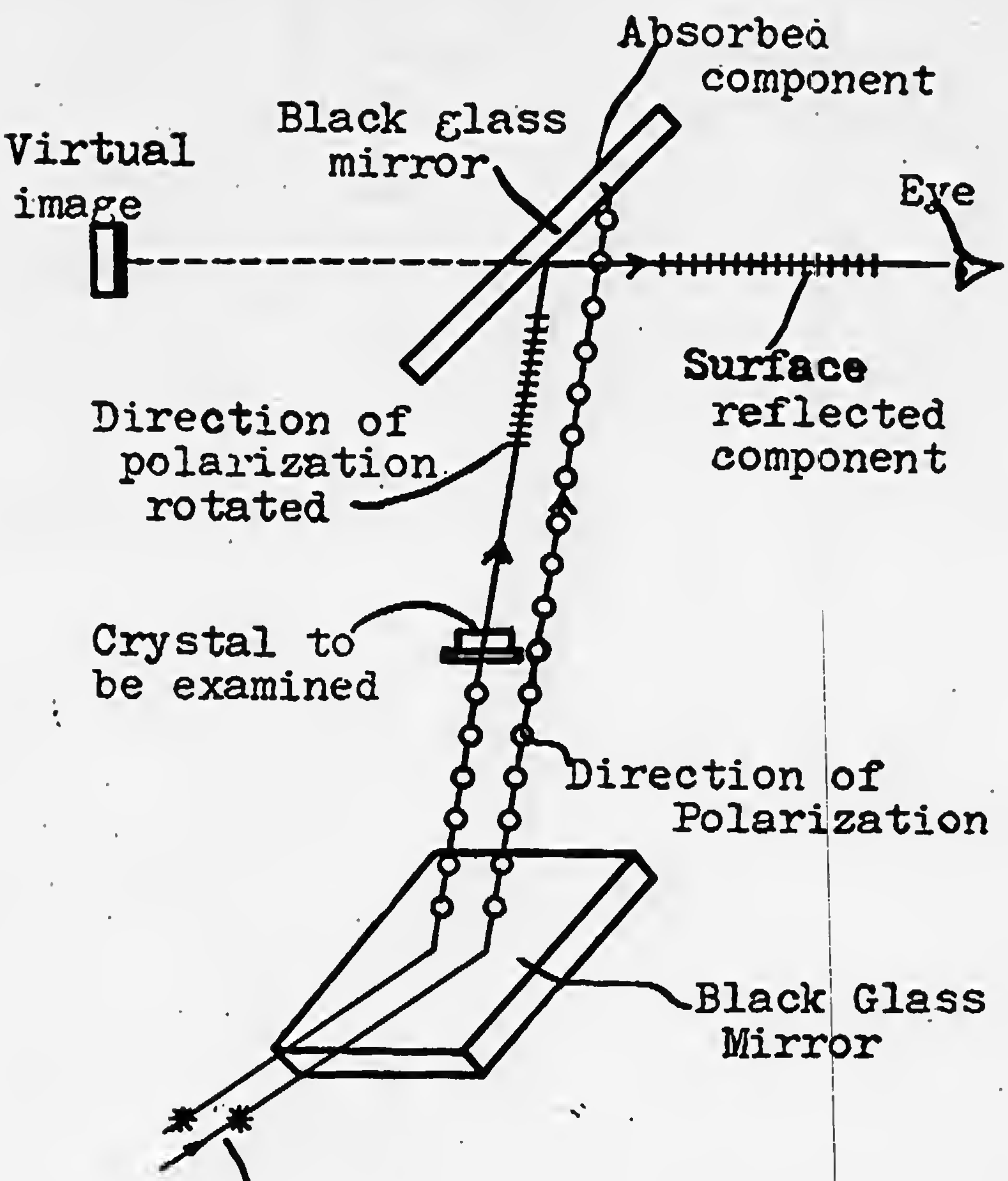
Preston (Tr. p. 109) shows a conventional polariscope. Such polariscopes have been known for over 100 years. To perform its function, the polarizing mirror and the analyzing mirror of a polariscope must polarize by reflection or by absorbing all light passing into its surface, and therefore is made of a uniformly polished black glass (that is, devoid of visual detail).

This is essential, because it is the function of the analyzer to show that polarized light impinging upon its surface becomes fainter and fainter until finally vanishing when one of the two black mirrors has been rotated ninety degrees from its parallel position relatively to the other mirror.

The present reference is simply a textbook explanation of the Biot polariscope.

Biot's polariscope for more than 100 years has been the conventional means in the art of polarization of demonstrating the constitution of polarized light. It is also generally employed in examining crystals or detecting strains, as in glass. This polariscope is shown in almost every textbook dealing with polarization. The polariscope is diagrammatically shown here.

Preston - Biot's Polariscope



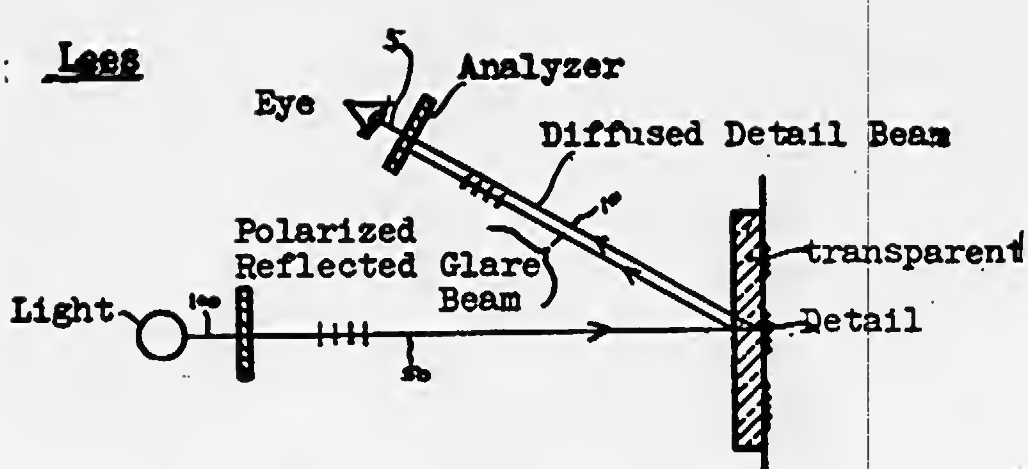
Two rays of unpolarized light from the light source are polarized by impingement upon polished black glass which acts as a mirror-polarizer. The mirror divides each ray of light into two components. One component travels into the black glass and is totally absorbed therein and the second component is polarized in the direction parallel to the plane of incidence of the light as shown by the circles on the ray. These two rays of light similarly polarized then travel upwardly. One ray travels unimpaired along its path to the second black glass mirror and this polarized light passes into the black glass mirror and is completely absorbed thereby. This component is absorbed because of its particular direction of polarization with respect to the mirror.

The second polarized ray travels through the crystal to be examined and this crystal rotates the direction of polarization of the ray so that when this ray strikes the second black mirror it is totally reflected from the surface of the mirror and is seen by the eye as a virtual image of the crystal. This is the surface reflected component and this component is completely reflected from the surface of the mirror, unlike the first absorbed component, because its direction of polarization is now parallel to the plane of incidence of the ray upon the mirror.

The first black glass mirror acts as a polarizer and the second black glass mirror acts as an analyzer. When the polariscope is used simply to demonstrate the constitution of polarized light the first black glass mirror can be rotated so that the observer, looking at the analyzer, either receives the completely reflected component or sees no light at all, depending upon the direction of polarization given the light by the first polarizer.

It is not and never has been claimed that there is any suggestion that this polariscope could be used for providing glare-free illumination. The polariscope could not be used to provide glare-free illumination. If it could have been so used, it would have been universally utilized by now, 100 years after its discovery.

Lees



Lees (Tr. p. 111) polarizes his light, but in no specified plane, at the source and then impinges the polarized light on the picture at an angle of ninety degrees to the plane of the picture (see his figure). Necessarily, then, he has to employ a second polarizer (or analyzer) at the point of observation in addition to the first polarizer. The second polarizer extinguishes the polarized light which is reflected from the surface of the painting (the surface reflected glare component) so that only the light that has passed into the picture and is reflected diffusedly can be viewed.

Not a single element of appellant's invention is set out in Lees. Neither appellant's vital and specific plane of polarization, nor his vital and specific angular direction of the polarized light onto the surface to be viewed are disclosed.

But appellant has not only accomplished the same result as Lees but at the same time has eliminated the polarizer at the observer's eye. This elimination of the second polarizer is an unexpected and novel result of vast practical and commercial importance.

Appellant's method is practical and commercial, whereas Lees is not because in Lees process, a polarizer must be placed in front of the observer's eye and coordinated with the polarizer at the source of light so that they will conjointly act to eliminate the glare component.

This means that,

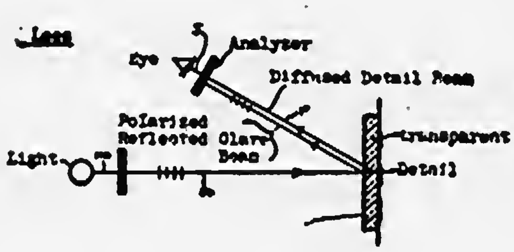
1. The observer must rotate his eyepiece polarizer until it polarizes the light filtered by the first polarizer. And when he has succeeded in this, he still does not have appellant's invention since appellant does away altogether with the eye piece polarizer.

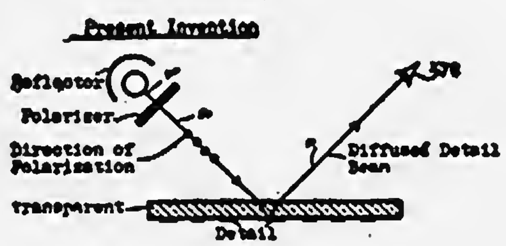
2. The observer must be supplied with a polarizer which means a glass eyepiece or spectacles with consequent distortion and eye strain.

3. Moreover, in Lees system, when metals are observed, the metal surfaces have a black appearance. When a metal surface is illuminated with polarized light and viewed through an analyzer it appears black because all light thereon is polarized light and this polarized light is extinguished or blocked by the analyzer. The fact that metal appears black in Lees system vitally affects the practicability of the system since it could not be used for ordinary general illumination that appellant's process is intended for.

These limiting facts, the cumbersome eyepiece with distortion and discomfort, and metal blackness, are real drawbacks which explain the fact that Lees has never gone into commercial use at all, whereas appellant's invention has been commercially accepted.

In addition to appellant's advantages of normal metal appearance and elimination of the viewing eyepiece, appellant's system has double the light efficiency of Lees.





Referring to the diagram of Lees shown above by way of example 100 parts of light from the light source are reduced to 50 parts by the first polarization. This 50 parts enters the surface and 10 parts emerges as an unpolarized diffused visual detail light component plus a polarized glare component. But in Lees, this 10 parts must pass through the analyzer to reach the eye and this analyzer polarizer cuts out half of the visual detail component light and all of the glare component, thus reducing the useful light to 5 parts.

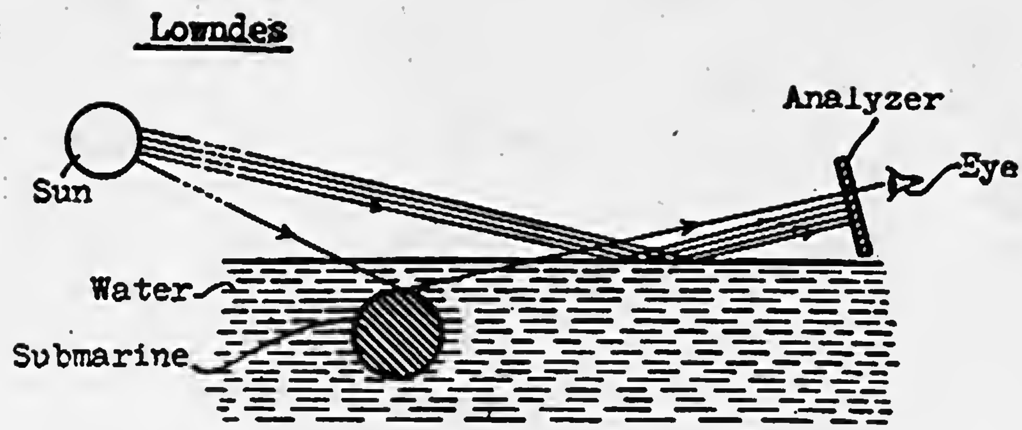
In the appellant's structure, similarly, the same 100 parts of light is reduced to 50 parts by the first polarization. This fifty parts enters the surface and 10 parts emerges as unpolarized diffused visual detail light. But this light travels directly without further polarization to the eye, and hence this entire 10 parts is used.

Thus, appellant can use a light source of half the power of Lees and obtain the same amount of illumination. This is still another new and unexpected result.

This efficiency comparison is set out as a fact and described in detail in the Pickard affidavit of record. The Patent Office Examiner does not question this fact.

Lowndes

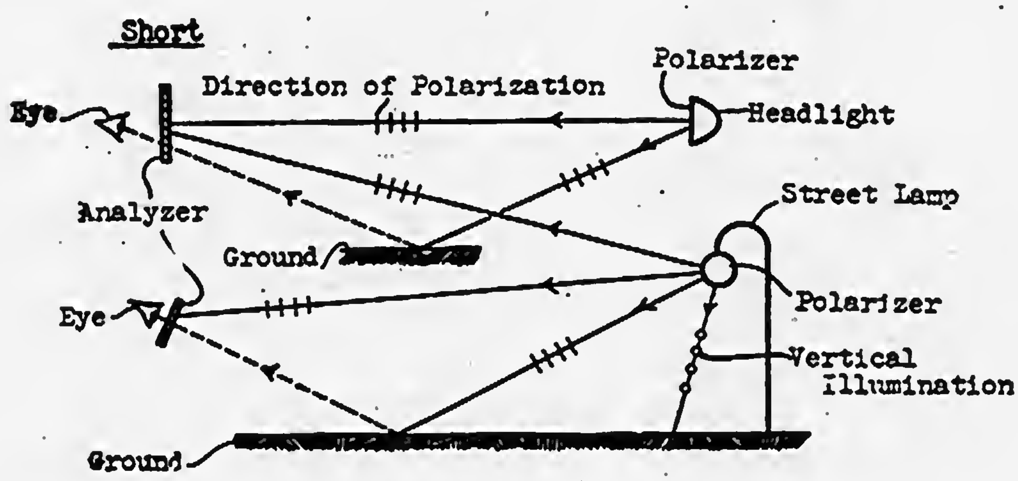
The British patent to Lowndes No. 177,948 (Tr. p. 108), discloses a method whereby an observer may see under the surface of a body of water for submarines. To this end, he must eliminate the surface reflected light from the body of water. To accomplish this, he places before the eye of the observer a polarizer which cuts out a certain amount of the light reflected from the surface of the water.



Here again it will be noted that the result is obtained by a polarizer in front of the observer's eye, the polarizer requiring adjustment by the observer (see p. 196 of Lees and p. 2 of Lowndes) in order to obtain the proper kind of polarization to cut down the glare.

Note that in the case of Lowndes, the observer not only must have a polarizer in front of his eye but he must remain in a particular position to eliminate the glare-rays. In all other positions the observer receives considerable glare. In appellant's process, however, the lamp provides glare-free light regardless of the position the observer may take, and furthermore the observer does not have to wear a polarizer over his eyes.

Short



Short, patent No. 1,733,915 (Tr. p. 97), discloses a system for the elimination of glare in automobile and road illumination. Short emits polarized light from a headlight or from a street lamp. This polarized light travels both directly towards the eye of a driver of an approaching automobile and also toward the eye of a pedestrian. Certain of this polarized light also is directed onto the ground and illuminates the ground. As will be noted from the Short patent (Figure 1) and from the diagrammatic representation here given, an analyzer is positioned in front of the eye of the driver and the pedestrian so that the direct light which is polarized light is completely blocked out and only that light gets to the eye which has been depolarized by the ground. This again is a polarizer-analyzer system of glare elimination and although similar generally to Lees is not even as pertinent to the present invention as is Lees, because it does not relate to the elimination of glare from an object such as a painting or other light refractive object with which the present invention is concerned.

Appellant differs from Short as follows:

1. In Short it is necessary that an analyzer be placed before the observer's eye. (The same impractical and objectionable device that the art has never accepted.)

2. Appellant's system has twice the efficiency of the Short system for the reasons pointed out in connection with Lees. Whenever there are two polarizations the light is cut in half both times.

Again the disclosure of Short has been known in this art for almost 25 years and in all that time there has not been any suggestion of any way of using Short to provide a practical non-glare illumination.

3. But most decisive of all should be the fact that Short does not disclose either of the two essential elements of appellant's invention (1) plane polarization in planes normal to the planes of incidence of the light (Short actually says that he has vertically polarized light (see p. 1 of Short) not horizontally polarized light), and (2) the direc-

tioning of the so polarized light onto a light refractive object at an angle of about thirty-three degrees thereto. Therefore, the Short system is completely incapable of attaining the appellant's result.

Summary

All of the references therefore do not teach appellant's invention, nor would, in theory, an expert in this art, be taught appellant's invention by the references because they proceeded upon a fundamentally different optical theory.

Each of the references relies on first, the polarization, and second, the analyzation of light to block out the polarized surface glare light. The references do not anticipate the present invention because they do not represent the same inventive concept or any equivalent scientific concept that could accomplish the same result with a change obvious to an expert in this art.

Each of the references relies on blocking out the undesired glare component of light by blocking the light at the eye with a polarized spectacle. Appellant provides a system where no spectacles are needed and a vastly superior non-glare illumination is achieved.

In this discussion great stress has been placed on the fact that appellant's invention is optically and physically different from the prior art polarized and analyzer systems for avoiding glare.

The Court should also consider that the world has long been aware of the need for non-glare illumination and has been searching for a means to accomplish it. The pertinent basic laws of optics, the necessary polarizing materials and the sources of illumination used in this invention have been available for a great number of years. The attempt to solve this problem is manifest by the references which are all dated before 1920. In spite of these facts there never was a practical solution to the elimination of glare from light.

Appellant has solved this vexatious and long standing problem by a very simple and effective system: A polarizer used to obtain a specific polarization of light and a directioning means to direct light at a particular angle before impingement on the surface to be viewed. No more is necessary and yet the problem was solved.

It is respectfully maintained that any combination of the references is fallacious because there is no suggestion in any reference of the fundamental concept of appellant's invention. Surely the fact that appellant has apparently very simply solved a difficult problem should not be counted against him.

In addition to being theoretically and practically different appellant's invention produces important new and unexpected results, as follows:

1. Appellant has made possible the elimination of the cumbersome analyzer that had to be placed in front of the eye in every system of the prior art.

2. Appellant has twice the light efficiency of the polarizer-analyzer systems of the prior art. This is confirmed in the uncontradicted affidavit of the expert Pickard (Tr. pp. 45, 46 and 47).

3. In appellant's system metal has its normal appearance. In the polarizer-analyzer systems of the prior art, metal has a black appearance. This is set forth in the uncontradicted affidavit of Pickard (Tr. p. 47).

4. Appellant has eliminated the distortion and limited field inherent in the systems of the prior art where the viewing must be had through a glass analyzer in front of the eye.

5. Whereas there was no commercial use or public acceptance of any glare-free illumination system or of the polarizer-analyzer systems of the prior art, appellant has given to the public a practical and successful commercial means for providing glare-free illumination.

It is submitted that this is a case in which the explorer in the art has by a flash of genius employed basic scientific knowledge to solve an old and recognized problem with available means in an entirely new and unexpected way.

The present invention was not even remotely suggested in the prior art. The references cited by the Patent Office do not represent a step by step approach which appellant has culminated with a logical refinement or by making use of newly developed knowledge and materials previously unavailable.

The contribution to the public good is very substantial. A new and useful step has been made in that glare-free illumination is now practically possible. The Patent Office has relied on systems that were known from 25-100 years ago, and which never produced practical non-glare illumination or led others to it. The present invention is not the result of a vast number of experiments by cut and try but is based on a departure from the previous teachings of this art. A new scientific principle is set out.

No detailed explanation of how the claims technically recite this invention is given or is believed necessary because the fact that the claims properly express appellant's invention was never contested by the Patent Office or in the Court below. The only question before this Court is whether what appellant has done constitutes invention.

No decisions on invention are given here because the question of patentability is decided by the Court on each set of facts and the Court is full cognizant of the prior law as to what constitutes patentability and invention.

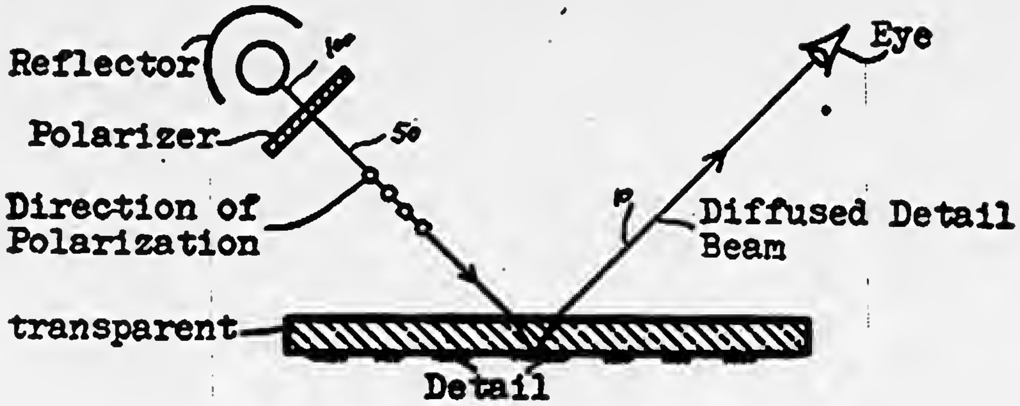
Appellant's system for non-glare illumination is entirely new in the art. It is neither shown or suggested by any previous teaching. It fills a public need long apparent. The grant of a patent monopoly for this contribution is believed to be clearly in line with the intent of the patent laws.

The decision of the Court below should be reversed.

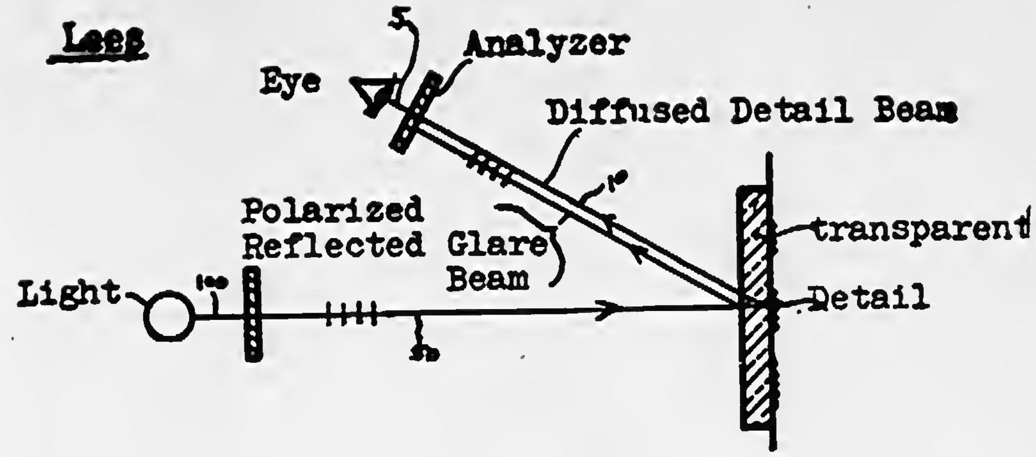
Orville N. Greene,
Attorney for Alvin M. Marks,
Appellant.

Karl W. Flocks,
of Counsel.

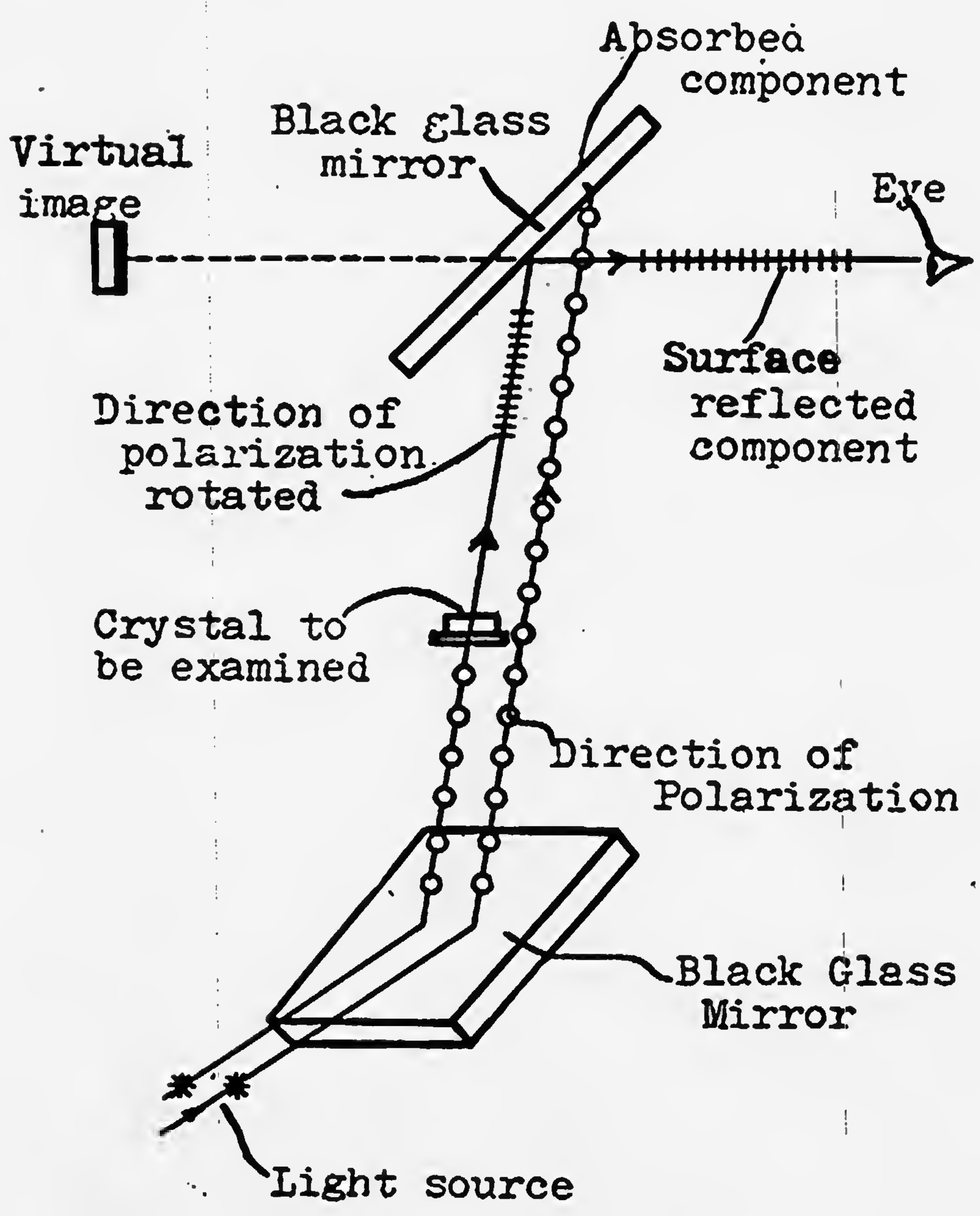
Present Invention



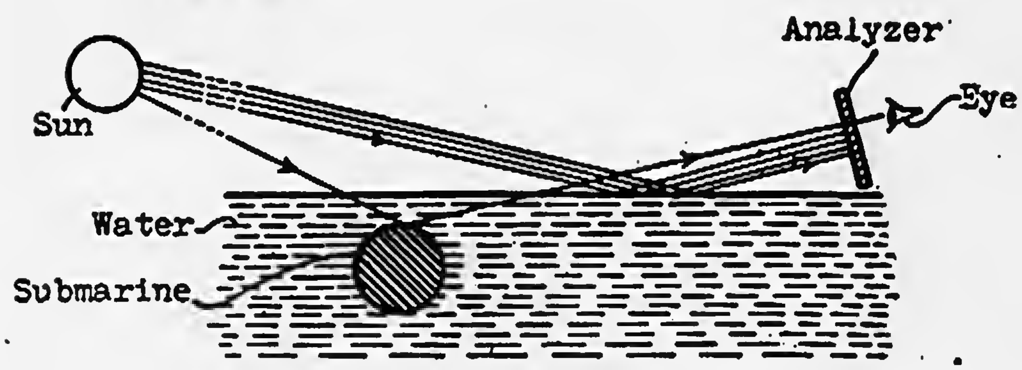
Lees



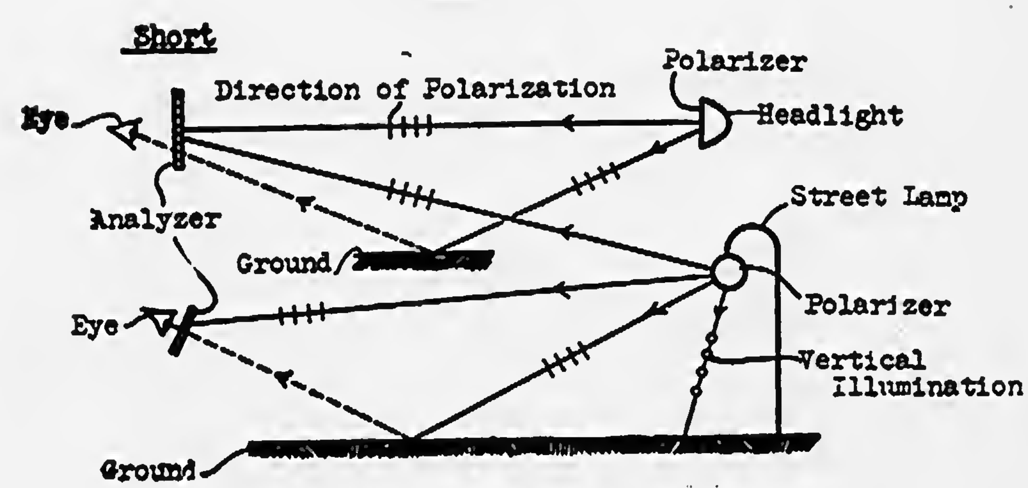
Preston - Biot's Polariscope



Lowndes



Short



APPENDIX TO APPELLANT'S BRIEF

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA

January Term, 1944

No. 8716

ALVIN M. MARKS,

Appellant,

vs.

CONWAY P. COE, Commissioner of Patents,

Appellee.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

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INDEX

Claims on Appeal. 1

1. The method of viewing a light refractive object having areas of different reflectivity by omitting the glare effect which comprises transmitting a beam of light to the light refractive object along an axis of substantially between 20 and 70 degrees to the normal to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam upon said light refractive object, thus substantially eliminating the reflective glare component of the beam; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light re- 2
fractive object; and diffusedly reflecting the light from said light refractive object to the objective with no polarizing medium between the object and the point of observation.

* * * * * * *

3. The herein described method of providing glare-free illumination of a light refractive object having areas of different reflectivity which comprises transmitting a beam of light to the light refractive object along an axis of substantially 33 degrees to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam upon said light refractive object, thus substantially eliminating the reflective glare component of the beam; impinging the re- 3
maining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and diffusedly reflecting the light from said light refractive object to the objective with no polarizing medium between the object and the point of observation.

* * * * * * *

65. A lighting device adapted to provide glare-free illumination for a viewing surface of an object having areas of different reflectivity comprising a light source, polarizing means, a reflector adapted to reflect light from said light source onto said polarizing means, said polarizing means being positioned to plane polarize the reflected light from said lighting device in planes substantially normal to the planes of incidence of said light upon the viewing surface, said reflecting means further directing said light through said polarizing means onto said viewing surface at an angle of about 33° to the surface.

* * * * * *

5 68. In a device for illuminating a body surface portion having an exterior light refractive layer, a light source located at a distance from said body surface portion; means for directing light rays from said light source onto said body surface portion at an angle in the range from 20° to 70° to said body surface portion; and a light polarizing layer extending across the path of said light rays so that substantially all usable light rays reaching said body surface portion from said light source pass through said polarizing layer, said polarizing layer being so shaped and so axially positioned relatively to the direction of the light rays, that substantially all light transmitted through said polarizing layer toward said body surface portion is plane polarized in planes normal to the planes of incidence of
6 said light rays upon said body surface and thereby substantially eliminating the reflection from the uppermost surface of said refractive layer of light rays transmitted to said body surface portion from said light source.

Judgment. 7

IN THE

DISTRICT COURT OF THE UNITED STATES

FOR THE DISTRICT OF COLUMBIA.

ALVIN M. MARKS,
Plaintiff,

v.

CONWAY P. COE, Commissioner of PATENTS,
Defendant.

Civil Action No. 16,116 8

This action came on to be heard at this term and thereupon, upon consideration thereof, it is, this 15 day of November, 1943,

ADJUDGED that the complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

(s) DANIEL W. O'DONOGHUE,
Justice.

Approved as to form: 9

(s) KARL W. FLOCKS,
Attorney for Plaintiff.

10 **Findings of Fact and Conclusions of Law.**

IN THE

DISTRICT COURT OF THE UNITED STATES

FOR THE DISTRICT OF COLUMBIA.

ALVIN M. MARKS, Plaintiff, v. CONWAY P. COE, Commissioner of Patents, Defendant.	Civil Action No. 16,116

11

FINDINGS OF FACT.

1. This is an action under R. S. 4915 (U. S. C., title 35, sec. 63) in which it was sought to have the Court find that the plaintiff, Alvin M. Marks, is entitled to have issued to him a patent containing claims 1, 3, 16, 34, 43, 44, 65 and 68 of his application Serial No. 240,608 for patent on a method of and device for producing polarized illumination.

2. At the trial the plaintiff dismissed the action as to claims 16, 34, 43 and 44.

3. The plaintiff's application here involved discloses a
12 method which is designed to eliminate the glare of reflected light. In carrying out this method the source of light is so placed that the rays from it will fall on the surface to be illuminated at a particular angle, it being stated that an angle of approximately 33° has been found suitable. The application explains that the component of reflected light which produces glare has a definite polarization and it is proposed by means of a polarizer placed between the light source and the object to eliminate this component

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of the light and thus prevent glare. The angle at which the observer views the illuminated surface is not material.

4. The patent to Short No. 1,733,915 discloses an illuminating apparatus and process whose object is the elimination of glare by means of polarization. In Figure 9 of this patent, there is disclosed a street lamp, some of whose rays are directed toward the ground at an angle of approximately 60° with the horizontal. Between this lamp and the ground there is placed a polarizer which is generally similar to that employed by the plaintiff and which polarizes the light in substantially the same manner.

5. The British patent to Lowndes No. 177,948 dis- 14
closes the prevention of glare in reflected light by placing a polarizing device between the reflecting surface and the eye of the observer.

6. Preston, "Text on the Theory of Light", 1895, Second Edition, MacMillan & Co., New York, N. Y. discloses on pages 291 and 292 the fact that light reflected from any given surface has a definite polarization and that such light may be eliminated by a polarizer placed between the reflecting surface and the eye. Preston also discloses that if a polarizer be placed between the source of light and the reflecting surface and properly adjusted, the reflected light may be eliminated.

7. The article by Lees published in "Discovery" August
1921, published by J. Murray, London, discloses on pages 15
195 to 197 a method of viewing old pictures in which polarized light is directed onto the picture and a polarizer is placed adjacent the eye of the observer whereby certain components of reflected light may be eliminated.

8. When it is desired that light having only a particular polarization shall reach the eye of the observer from a reflecting object, it is obvious to place a polarizing device

either between the source of light and the object or between the object and the eye of the observer.

9. The exact angle at which light must be directed on an object in order to eliminate or minimize the glare is a matter of experimental determination only and does not involve invention.

10. It would not require invention in view of the British patent to Lowndes or of the Preston or Lees publication to place a polarizer between the source of light and a surface to eliminate from the light the component, which when reflected, produces glare.

17 11. Claims 1, 3, 65 and 68 of the Marks application define nothing inventive over the short patent and especially over the device shown in Figure 9 thereof.

12. Claims 1, 3, 65 and 68 of the Marks application define no invention over the prior art.

13. Claims 1, 3, 65 and 68 of the Marks application are unpatentable in view of the prior art.

Conclusions of Law.

1. The plaintiff is not entitled to a patent containing any of claims 1, 3, 16, 34, 43, 44, 65 and 68 of his application, Serial No. 240,608.

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2. The complaint should be dismissed as to all the claims involved.

Nov. 15, 1943.

(S) Daniel W. O'Donoghue,
Justice.

19

Extracts from Specification of Application Serial No. 240,608.

Pages 1-5:

My invention relates to the illumination of surfaces and is directed more particularly to the modification of light impinging on or reflected from surfaces in such manner as to eliminate or minimize glare when said surfaces are viewed by the human eye or by photography or television.

My invention further relates to illuminating means adapted to transmit polarized light, and more specifically my invention relates to a lighting fixture so constructed that it transmits polarized light and non-polarized light.

My invention further relates to a sheet polarized and to various methods of producing the same, and to various 20
modified forms of such sheet polarizers.

First with regard to the illuminating of surfaces:

It is well recognized that, when a surface is seen by reflected light and particularly when the source of light is positioned at the opposite side of the object viewed on said surface, the reflected light impinging upon the eye will ordinarily result in more or less glare depending upon several factors, among which may be mentioned the light absorbing qualities of the surface, the character of said surface, the position of the source of light with reference to the surface and the eye, and the intensity of such light. In every day life, these phenomena manifest themselves, for example, when a person is reading a book with the light positioned on the opposite side of the book from the eye 21
and in substantial alignment so that the light impinging on the printed page is reflected directly to the eye. If the book has calendared pages, it is practically impossible to see the print.

Another example is found in the instance where a person seeks to view the grain of wood of a desk through a glass plate superimposed thereupon when the desk is positioned between the observer and a window through which sunlight is streaming upon the desk top. In such instances, the reflected glare is so pronounced as to be almost blinding.

22 *Extracts from Specification of Application Serial No. 204,608.*

My experimentation and research in connection with these phenomena have led me to certain conclusions on which the present invention is based. I have found that when light is reflected from any insulating surface, the light reflected from the upper molecules of the surface, that is to say the upper layer, is not appreciably affected by the nature of the material. By "insulating surface", I mean the superficial surface of material which is substantially a non-conductor in the electrical sense. This includes metallic or other electrically conductive bodies coated or covered by an insulating film of oil, lacquer or the like.
23 My observations have shown in this connection that when ordinary light strikes, for example, a glass surface, a large proportion of that portion of the beam which is reflected from the plane of the surface or by the surface layer is polarized in a plane normal to the glass surface, while that portion of the light which penetrates the surface is refracted thereby and transmitted to the deeper layers below the surface and there reflected and modified to a great extent by the absorptive properties of the material below the surface layer. If the reflected beam and the refracted beam are at substantially ninety degrees to one another, the reflected beam may be totally polarized in accordance with Brewster's law. At other angles, however, the polarization of the reflected beam is not complete. However, for the angles between say twenty degrees and seventy degrees
24 to the normal to the surface viewed, a substantial fraction of the purely reflected light is plane polarized; that is for all angles at which surfaces are ordinarily viewed, a substantial fraction of plane polarized light comprise the light reflected from the surface. In any event, if it be assumed that the surface viewed is a surface of a desk with a glass plate thereover, an incident beam of ordinary light impinging upon the exposed upper surface of the glass will be broken up into two distinct beams, namely, a reflected beam

Extracts from Specification of Application Serial No. 204,608. 25

and a refracted beam. The reflected beam will be substantially polarized in a vertical plane, while the refracted beam will pass through the glass plate and impinge upon the wooden table top which will reflect the said refracted beam through the glass plate to the eye of the observer. As the absorption of the refracted beam by the grain of the wood is in readily distinguishable degrees, the beam reflected from the wood surface will exhibit a marked contrast so that the grain of the wood may be readily seen. There is thus impinging upon the eye this latter contrasting beam and also the beam reflected from the glass sur-
face and substantially polarized in a vertical plane, but 26
inasmuch, in some circumstances, as the vertical plane polarized reflected beam embodies materially greater intensity, the eye reacts more pronouncedly thereto and it is practically impossible to see the contrast in the reflected refracted beam.

It has been heretofore suggested that reflective glare might be minimized through the utilization of so-called "analyzers" in the form of spectacles or binoculars adapted to be worn by the observer or held in his hands in such a manner as to intercept the reflected beam directly before his eyes and after the beam has left the object to be viewed.

I have observed through my researches, however, that if it is possible to substantially eliminate, prior to impingement on the surface, the beam which would be reflected
from the glass surface in the example given, that the other 27
beam of contrasting character may be properly and effectually observed without eyestrain and without the use of analyzers. The object of this invention, therefore, in a generic sense is to so modify light transmitted to a surface to be viewed as to substantially eliminate therefrom the glare component of such light and thereby permit contrast in said surface to be clearly observed without an analyzer. This I have found capable of accomplishment by

dividing ordinary light into two distinct components of plane polarization at right angles to one another and eliminating therefrom the one plane polarized in a plane normal to the surface viewed and prior to impinging of the light upon said surface. To accomplish this I plane polarize the light prior to permitting the same to impinge upon the surface to be viewed, so that only plane polarized light impinges upon and is reflected from the object to be viewed.

In practically carrying out the invention, I interpose between a source of light and the object to be viewed a
29 polarizing medium which will plane polarize the beam in a plane including a ray in the beam and normal to a plane which passes through said ray and its geometric projection on said surface, so that when the beam impinges upon the object, it will be divested of light in its plane of polarization normal to, and which would ordinarily be reflected by, the surface or surface layer of the object and cause a glare and thus I eliminate the purely reflected beam, while the beam of light in the former plane of polarization is refracted, penetrates the surface layer, and is transmitted to the lower layers and modified to a greater extent by the absorptive properties of the material of such object, and is reflected thereby in a more or less diffused way not conducive to glare, but rather in a manner to give well defined contrast between adjacent areas which differ in absorptive
30 ability. This reflected diffused contrast-carrying beam is substantially unpolarized.

Various apparatus may be employed in carrying out the present invention and in every instance polarization takes place prior to the impingement of the beam on the object. The particular apparatus employed will of course depend upon the type of illumination desired, such, for example, as direct illumination as distinguished from indirect illumination, in for example the art of house lighting.

Extracts from Specification of Application Serial No. 204,608. 31

The invention is directed primarily to apparatus for carrying out the present invention, but it also includes the method whereby this result is achieved.

With regard to illumination means for illuminating with polarized light:

The problems of providing non-glare lighting and the benefits of such non-glare light have long been recognized. The potential dangers of eye strain and sight difficulties brought about by reading in a glaring light are commonly recognized, and many attempts to provide a scientific light to prevent such eye strain have been made. Commonly, such attempts to overcome these problems have concerned 32
themselves with diffusion of light and with light direction. But further scientific research has revealed that diffused light by no means solves the difficulty of glare and that the true solution for providing a light that will enable reading, without strain or tiring effects necessitates the use of polarized light. Polarized light, by its physical nature and particularly when employed as I shall hereinafter set forth, provides an ideal light which illuminates without objectionable reflection and glare.

* * * * * *

Pages 40-41:

Figures 18 and 19 are diagrammatic views showing the manner in which light is transmitted to an object according to different principles, Figure 18 showing conventional 33
methods and Figure 19 showing the method according to this invention.

Figures 20, 21 and 22 show apparatus embodying the present invention for carrying out the method illustrated in Figure 19. In these figures an appropriate reflector and associated parts are shown in section.

Figure 23 is a plan section on the line 75-75 of Figure 22.

34 *Extracts from Specification of Application Serial No. 204,608.*

Figure 24 is a perspective section of a structure similar to that shown in Figure 20, but with greater spacing between the polarizing element and a diffusing plate than in the corresponding parts in Figure 20.

Figure 25 shows the manner in which a pair of lamps, such as shown in Figure 20, may be arranged to simultaneously illuminate a picture such, for example, as an oil painting in order to obtain satisfactory illumination of a relatively large surface uniformly.

Figure 26 is a fragmental view of a composite plate which I may employ in carrying out the present invention
35 and which also constitutes part of this invention.

Figure 27 is an elevation showing the present invention as incorporated in a direct lighting system as in the previous views, but showing direct lighting in all radial directions.

Figure 28 is a front elevation of another embodiment of the present invention as incorporated in a direct lighting system.

Figure 29 is a section on the line 13-13 of Figure 12.

Figure 30 illustrates an indirect lighting fixture embodying the present invention in elevation.

Figure 31 is a diagrammatic plan view of the polarizing member used in the structure of Figure 30.

Figure 32 shows diagrammatically another form of indirect lighting fixture in central section.

36 Figure 33 shows diagrammatically another way in which a light beam may be manipulated in a structure of the general character shown in Figure 16.

• • • • • •

Pages 66-76a:

In Figure 18 of the drawings, I have illustrated diagrammatically the manner in which light conventionally acts upon a surface of insulating material. Let it be assumed, for example, that the reference character A constitutes

Extracts from Specification of Application Serial 37
No. 204,608.

the object to be viewed and that this object is an insulating material, such for example, as a transparent plate of glass 2″ having an upper surface S and an underlying wooden body 3″. The object A may, however, constitute a body 3″ which it is desired to observe and over which is positioned a transparent coating 2″ or the part 3″ may constitute a sheet of paper having printing thereon with a gloss finish corresponding to the part 2″. I have found that all insulating surfaces of whatever character possess these properties; the surfaces may be indeed of such diverse character as that of cloth or a rug, which ordinarily are
not thought of as having a glossy finish. Nevertheless the 38
principle herein explained for the comparatively simple case of say a glass plate over a grained wood surface extends to and includes all possible surfaces; except those of conductors such as metals. There is always an improvement in the contrast of adjacent areas of differing absorptive ability when the light component polarized normal to the viewed surface is eliminated according to this invention.

In any event, the mode of operation is the same. In this figure, two vertical planes are shown. The surface S may, however, be other than horizontal in which the planes 4″ and 5″, normal thereto, will be other than vertical. The vertical plane 4″ is normal to the upper plane surface of the part 2″, while the plane 5″ is normal to the plane 4″
and normal to the upper plane surface of the part 2″. The 39
light source indicated at 6 is presumed to be substantially in the plane 4″, while the observer or objective 7″ is presumed to be in the same plane. Ordinary light from any suitable source 6″, illustrated as a candle, although it may be natural or artificial, either radiant or optically projected, passes from the source 6″ to and impinges upon the surface S at a point designated 8″. Upon contact with this surface at 8″ which we will assume to be a polished surface,

the beam is split into two parts, one part 9″ is reflected directly from the surface and through such reflection is substantially polarized in a vertical plane 4″, as indicated by the lines 10″ which denotes polarization in a plane normal to the surface 2″. The other part 11″ is refracted at the surface of the part 2″, passes downwardly through said part and impinges upon the more or less light diffusive upper surface of the part 3″ at a point indicated at 12″. The diffusive character of the part 3″ at this point reflects the thus refracted beam in an upward direction through the thickness of the part 2″, so that it merges from the
41 upper surface of the latter in diverging rays constituting a beam 13″ diffused to the extent that it will not produce glare. The ray 9″, however, substantially plane polarized in a vertical plane, may be referred to as the glare effecting portion of the transmitted beam and this impinges upon the eye 7″ and causes the glare, making it impossible for the eye to properly analyze the characteristics of the diffused beam 13″. The foregoing is illustrative of conventional observation and constitutes no part of the present invention being here illustrated merely to form a basis by which the present invention may be more readily understood.

Beam 9″ being surface-reflected is not affected by the absorptive properties of the underlying layers of the surface such as 3″. The intensity of 9″ is therefore constant
42 over the entire surface S. When the observer forms an image of the surface viewed, adjacent areas of that image are more readily distinguished if the ratio of the larger intensity of one area to the lesser intensity of an adjacent area is great. The beam 9″ always contributes to reducing the ratio of intensity of adjacent areas of the observer's image of the object viewed. Thus, for example, if the absorptive ability of the underlying layers of adjacent areas of a surface he say, such that the 90% of the light

that is transmitted thereto (10% being surface reflected) and one area diffusively reflects 20% of the light, and the adjacent area diffusively reflects 5% of the light; then if the surface reflected component is eliminated the contrast ratio is $\frac{20\%}{5\%} = 4$ times; whereas if the surface reflected component is not eliminated, the contrast ratio is

$$\frac{20 + 10}{5 + 10} = \frac{30}{15} = 2 \text{ times.}$$

44

By reference now to Figure 19, wherein similar parts have the same reference numerals, the source of light 6″ constitutes a source of ordinary light. It is adapted to disperse its rays in the direction to impinge upon the surface S of the part 2″ at the point 8″, as heretofore, but between the source 6″ and the point 8″, is interposed a polarizing medium P, so constituted as to plane polarize the light from the source 6″ in a plane normal to plane 4″ and including the ray from the source 6″, as indicated by the lines 14″, whereby the light passing through said polarizing medium and impinging upon the surface S at 8″ is divested of the beam 9″, shown in Figure 18, i.e., the vertical component of the transmitted beam, while the component 15″ of such transmitted beam is refracted at the 45
surface S and passes downwardly through the part 2″ to impinge upon the lower surface of the part 3″; or in general passes below the upper surface layer into the body of the material where it may be differentially absorbed and diffusively reflected by adjacent areas. It is thereupon reflected from said part 3″ in a diffused manner, resulting in the diffused reflected beam 13″, only, it being noted from Figure 19 that the beam 9″, appearing in Figure 18, and plane polarized in the vertical plane 4″ is absent.

46 *Extracts from Specification of Application Serial No. 204,608.*

The beam 13″ is of such character that it will not cause glare, but will on the contrary provide clear contrast between adjacent portions of the part 3″ and permit them to be effectually seen by virtue of the reflected diffused beam 13″ to which I have referred, for it will be observed that the glare causing vertical component has been wholly eliminated, while the remaining component has been so modified as to render glare therefrom wholly absent or negligible.

In the showing of Figures 18 and 19, I have referred to only one point 12″, but it is to be understood that the
47 phenomena described is duplicated for other points in the upper surface of the part 3″.

It will, of course, be understood that the parallel lines indicating planes of polarization shown in Figures 18 and 19 are not intended to indicate complete polarization nor degree thereof, but merely show the predominating planes of polarization.

I have referred in connection with Figure 19 to the employment of polarizing mediums more specifically designated by the reference character P. In practice, these polarizing mediums may partake of various forms and I, therefore, do not limit the present invention to any specific construction, but will hereinafter describe several alternate polarized devices which may be employed in this connection. However, for the purpose of illustration at this point,
48 it may be stated that I may use with high efficiency the polarizing medium fully disclosed in my application, Serial No. 662,090, filed March 22, 1933, which issued into Patent No. 2, 104,949 and directed to "Crystalline Formation". Said application discloses among other things a polarizing medium comprising a transparent supporting member, such as a sheet of glass and on one surface of which sheet is supported a crystalline layer having the characteristic that when a light beam is passed through the glass and through

the layer, the emergent beam will be polarized in a predetermined plane. This structure is referred to here as well adapted for the purposes exhibited in Figure 19, wherein the said polarizing device may be positioned as indicated at P in this figure. In the arrangement of Figure 19, this polarizing device P may be mounted on or form part of a lamp casing or fixture. The objective 7 may be the eye of an observer, the lens of a camera or the like.

In Figures 20 to 32, I have shown practical examples of the embodiment of Figure 19 in commercial lighting fixtures, some of which are adapted for direct lighting and some for indirect lighting. 50

Referring first to Figure 20, wherein I have shown direct lighting, such as may be conveniently incorporated in a desk lamp, 17″ designates the lamp standard to which an appropriate lamp casing shown in the form of a reflector 18″ is pivoted at 19″. An electric lamp 20″ is housed within the reflector and current is supplied thereto through wires in the usual manner. Across the open end of the reflector 18″ is a polarizing medium P which may conveniently take the form which is shown in my copending application, above referred to, and I have shown mounted adjacent the polarizing medium and on the interior of the reflector a diffusing plate 21″ of ground glass or the like to break up the image of the lamp filament prior to the passage of the beam through the polarizing device P. The beam from the lamp
passes through the diffusing element 21″ and then through 51
the polarizing element P which serves to plane polarize the emergent rays 22″ and 22″ in planes normal to a plane normal to A and including the rays 22″ as described in connection with Figure 19. As such, rays 22″ impinge upon the object A with the same results as described in connection with Figure 19. Light polarized in the plane of polarization normal to the surface A is thus eliminated and the diffused component results in the beam 13″ being

composed only of light differentially reflected by the contrasting areas of A. In Figure 20, the casing 18″ of the lamp may be pivotally moved on the standard 17″ into such optimum angle as to give the best results for reading or otherwise as may be desired.

The structure of Figure 21 differs from the structure of Figure 20 merely in that a different form of polarizing medium P is employed. In this instance, polarization is accomplished by passing the light beam through an appropriate pile of transparent plates of glass or any other appropriate polarizing substance or substances so that the
53 emergent beam 22″ is plane polarized in a plane; a line in which, normal to the ray 22″ is parallel to the surface viewed; the reflected polarized beam 22a″ here being absorbed on an optically black surface as shown.

The casing 18″ shown in Figure 21 is, for a portion thereof adjacent the source of light, of parabolic configuration, so as to parallel the rays of light which pass through the polarizing element P. Beyond this parabolic part of the reflector, the extended portion of the casing is preferably lined or coated with some absorbing medium, such, for example, as a flat black coating indicated at 18a″ to absorb those rays of light which cannot efficiently be paralleled, as well as such rays as are reflected from the surface of the polarizing medium P. In this form of construction, moreover, an absorbing shield 18b″ is also preferably positioned
54 forwardly of the source of light to preclude the passage through the polarizing medium of the direct divergent rays from the source of light and which could not be efficiently polarized.

In the structures of Figures 22 and 23, the same standard is employed as in the preceding structures, but the casing 23″ is of somewhat different form. Ordinary light from the lamp 20″ is first passed through an appropriate optical system 24″ which parallel the rays causing them to impinge upon an appropriate set of plates P of transparent material or materials and the last plate of which is preferably coated at its back surface with lamp black or the like. The plates are set at such angle that the beam 22″ will be reflected in the desired direction and the light of said beam will be plane polarized in a plane, a line in which, normal to the ray 22″, is parallel to the surface A.

In Figure 24, I have shown in perspective section a structure substantially the same as shown in Figure 20, but with the diffusing plate 21″ set a further distance away from the polarizing medium P. The reflector 18″ employed in
this connection is practically the same as shown in Figure 56
20 and in these figures, these reflectors are preferably, though not essentially, parabolic. The reflector of Figure 21 is essentially parabolic for the rays impinging on plates must be parallel to be effectively polarized.

In Figure 25, two sources of light of the character shown in Figure 20 are employed being positioned in opposed relation to one another, so as to collectively illuminate the object A which in this showing may be a picture, such as an oil painting or the like or a piece of tapestry, the lamp casings 18″ being tilted at the proper angle to give maximum non-glare illumination and to properly cooperate with one another.

Reference has hereinbefore been made to a polarizing medium P used in conjunction with a separate diffusing
medium 21″. If desired, these two mediums may be incor- 57
porated in a unitary construction Pd forming part of this invention and shown in Figure 26. In this figure, a transparent plate 25″ such as a plate of glass, is coated on one side with a polarizing film P and at its opposite side, it is provided with a diffusing surface 21″, which may conveniently be produced by either employing a diffusing coating or sand blasting surface of the plate 25″. The said composite construction may be used in conjunction with

58 *Extracts from Specification of Application Serial No. 204,608.*

any practical arrangement employing the invention, as set forth in Figure 19, i.e., any structure wherein the beam is adapted to pass through the diffusing and polarizing elements. Figures 28 and 29 show another application of the invention to direct lighting and more particularly in a wall fixture. Here two composite units Pd, as shown in Figure 26, are mounted in an appropriate frame 26″ before an appropriate source of light 6″ with the result that the beam which passes through the units Pd will be plane polarized in a plane normal to the vertical. A room properly lighted by a series of fixtures of the kind shown in
59 these figures will be devoid of glare on horizontal surfaces.

Another adaptation of the invention is shown in Figure 27 in which figure a plurality of strips each comprising composite units Pd are mounted in a circular frame 26″ constituting a suitable support and within the frame is positioned a source of light 6″ such as an electric lamp. All rays of light which pass through the units Pd will be plane polarized in a plane normal to the vertical plane.

In the structure of Figure 30, a somewhat different arrangement is shown. The source of light 6″ is mounted within the lamp casing 18″ across the top of which is positioned a polarizing plate or a composite plate, such as shown in Figure 26. The light is thrown from the source of light directly and by reflection upwardly through the polarizing plate P and on to a conical diffuser 27″, pref-
60 erably of metal, positioned above the same.

The polarizing medium used in the construction of Figure 30 is shown diagrammatically in Figure 31 and must be of special construction. It is preferably built up of a plurality of segmental parts or sections, each of which is adapted to polarize the light in planes normal to the radius, so that when these several sections are assembled, as shown, polarization will take place substantially normal to all radii. That is to say, light passing through any portion of the polarizing medium will be properly polarized before impinging the reflector 27″.

The surface of the diffuser 27″ if of metal will simply reflect the beam as indicated. This surface may, however, be composed of metal flakes in transparent suspension with haphazard orientation, so as to reflect the light in all directions. Such a surface may be conveniently formed by using aluminum paint. My observations show that metallic surfaces will not depolarize an incident polarized beam so that even though the surface of the part 27″ is simply metallic surface, satisfactory reflection will result without
glare, but I preferably use a diffusing surface of metal 62
flakes to get a better distribution of the light. If the part 27″ were non-metallic, such as a flat white paint or calcined background, the polarized beam impinging thereon would be depolarized, but this might be overcome by covering said surface with metal flakes as stated.

The structure shown in Figure 32 is a fixture embodying the combination of several of the arrangements hereinbefore referred to. Light from the source 6″ passes through an optical system 28″ to parallel the rays and thence is passed through a polarizing pile P which plane polarized the beam in a horizontal plane. The thus polarized beam is received upon the metallic or other non-depolarizing reflecting surface 29″ and reflected upwardly against a diffusing surface 30″ embodying the metal flakes in trans-
parent suspension and with haphazard orientation and 63
from this surface the polarized light is reflected in diffused condition throughout the room in which the fixture is suspended. In order that the light may be dispensed from all sides of the fixture, the optical system 28″ may be in the form of an annular lens coaxial with the source of light 6″ and the pile of plates which constitute the polarizing device may be in the form of hollow truncated walls coaxially arranged and of the same pitch. Similarly, the re-

flector 29″ may be in the form of a frustum of a cone with the deflector 30″ similarly formed as will be understood by those skilled in the art. 31″ is an optically black absorbing surface for the discarded polarizing component.

The structure of Figure 33 is quite similar to the structure of Figure 32, with the exception that the polarizing element P is in the form of a pile of plates with the outermost plate having a light absorbing backing 31″, such as a lamp black coating, such as to function in the manner described in connection with Figure 23, the light being polarized during reflection instead of refraction as in Fig-
65 ure 32.

The foregoing commercial embodiments of the invention are illustrative of a wide variety of apparatus which may be employed in practicing the present invention. They all, however, operate on the generic principle that the light is polarized prior to impingement upon the surface to be viewed. In certain of the apparatus showings, the object is viewed by direct illumination while in others the object is viewed by so-called indirect illumination. In every case, however, the glare producing component of the light beam emanating from a common source of light is eliminated in such manner as to obtain a highly satisfactory contrast between different portions of an object having areas of varying degrees of light absorptive properties. As a result, the observer will see these different portions of the
66 object in proper contrast without eyestrain or optical fatigue.

In direct lighting arrangements, such, for example, as illustrated in Figures 20 and 21, direct view of the source of light is shielded by the casing 18″, while the angle at which the casing is tilted shields direct rays of polarized light from the line of sight of the observer, so that he views the object A solely by reflected light. The angle of adjustment of the casing is such in these cases as to give the best results. In the forms of the invention typified by the non-glare surface illumination, whose beam is included in the line of sight of the observer, such, for example, as in Figures 27 or 28, a diffusing screen should be used to give a large uniform field of lower intensity. In this connection, it is important to note that the polarizing plates referred to form a highly practical way of polarizing light coming from a diffusing screen, since they polarize well for rays having all angles of incidence.

In practically carrying out this invention, I prefer, in all
instances where the source of light is within the lines of
vision of the observer, to utilize in conjunction with the 68
polarizing medium a diffusing screen in order to obtain a
large field of illumination of lower intensity. However,
where the light is contained within a casing or holder so
constituted as to shield the source of light from the direct
view of the observer, such a diffusing screen is not necessary although it may be used if desired.

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Figs. 18 to 33 of Drawings of Application Serial No. 240,608.

(Bound in opposite)

Fig. 18

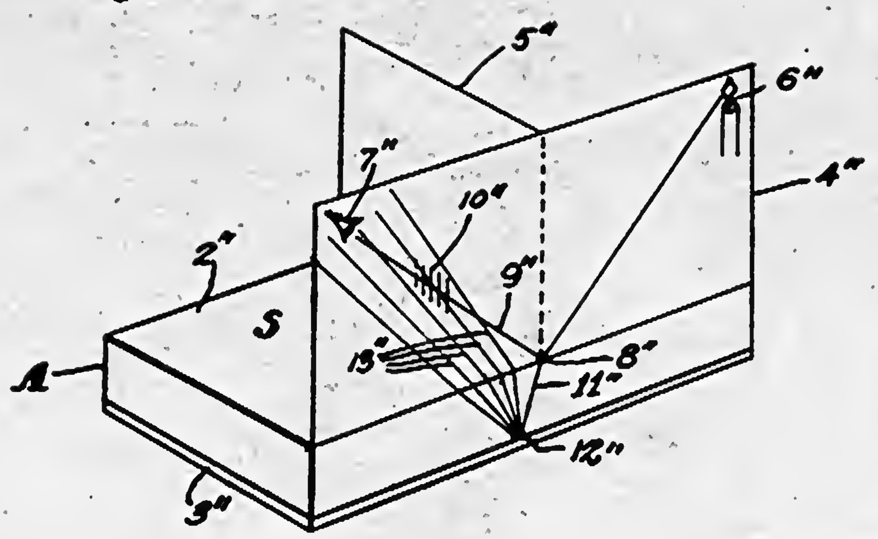


Fig. 19

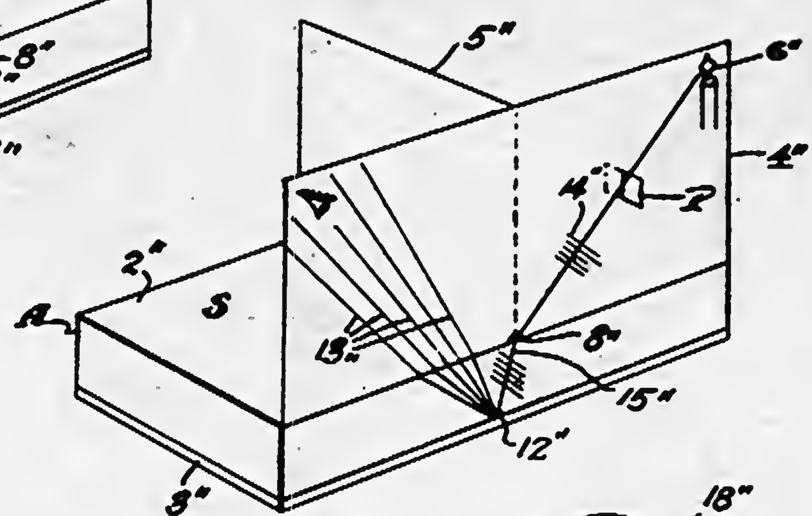


Fig. 20

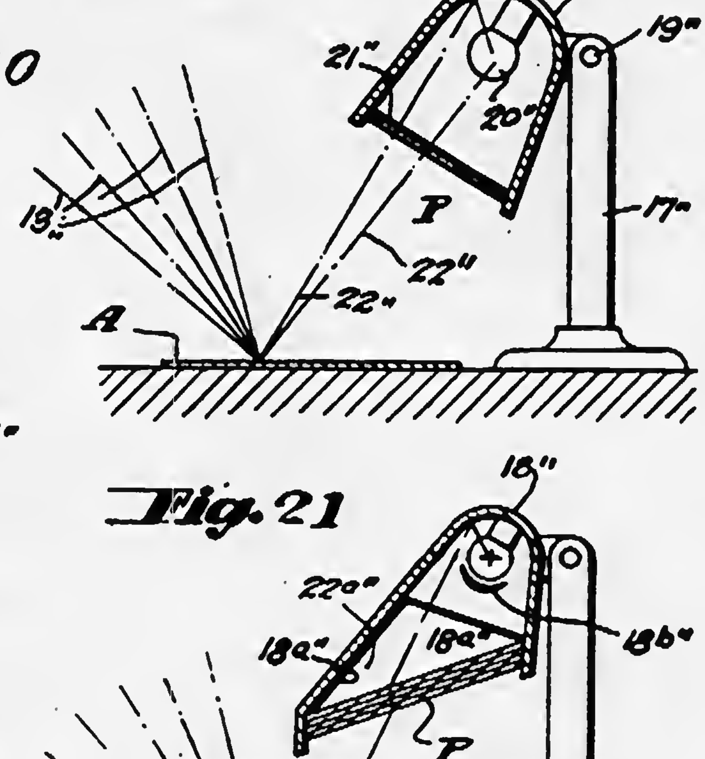


Fig. 22

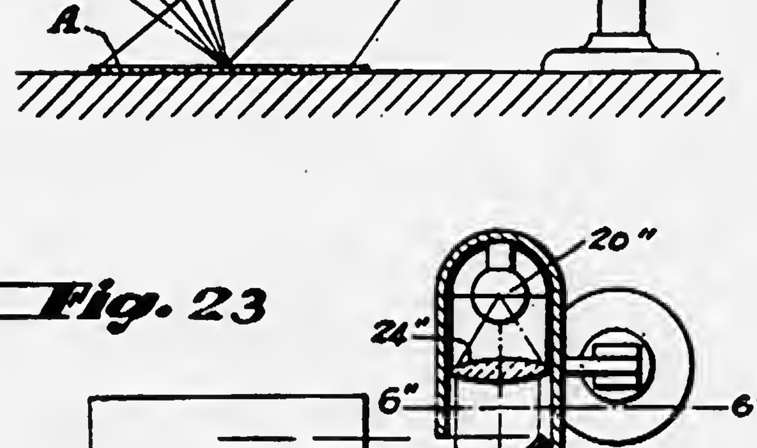


Fig. 21

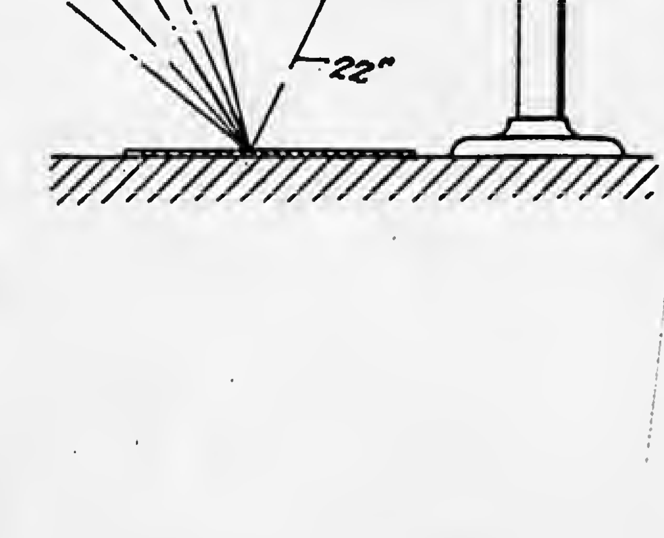


Fig. 23

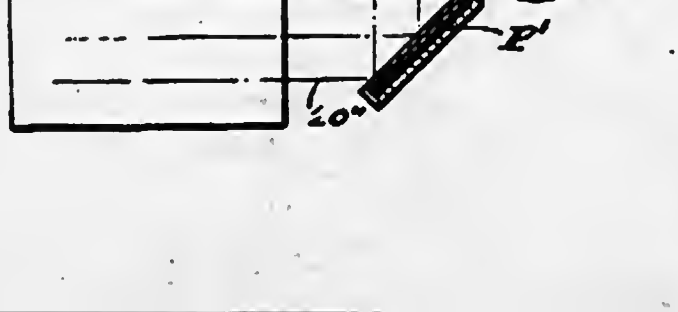


Fig. 25

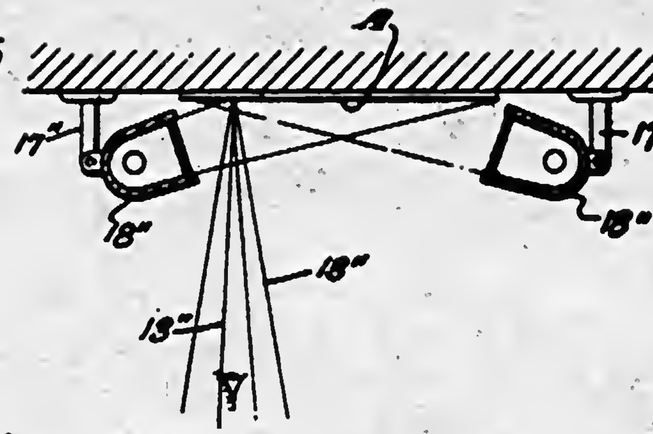


Fig. 24

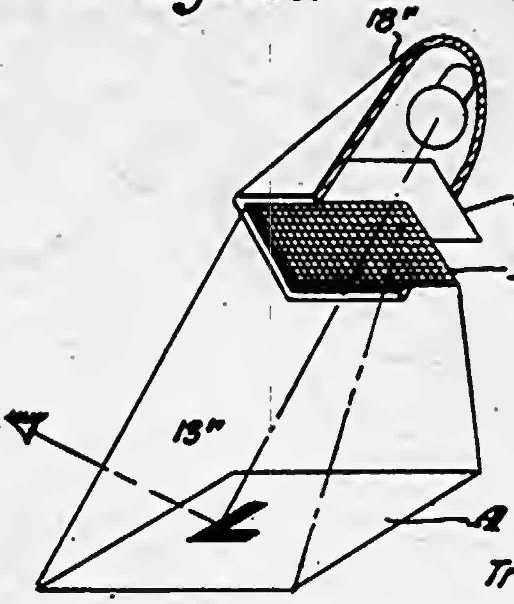


Fig. 26

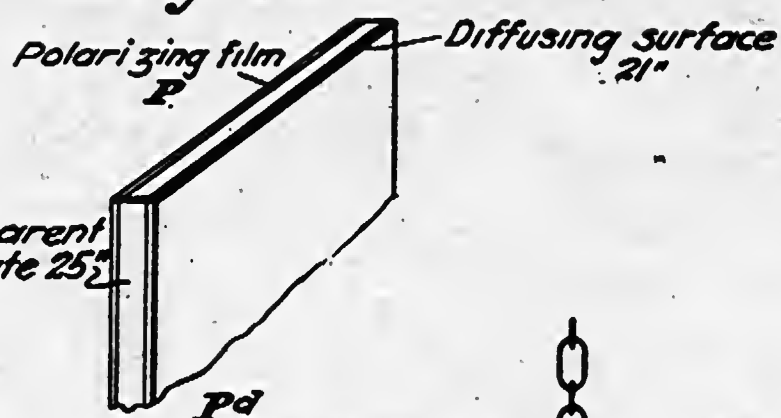
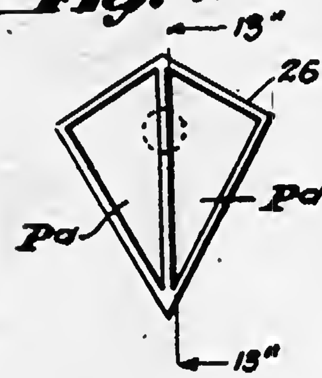


Fig. 28



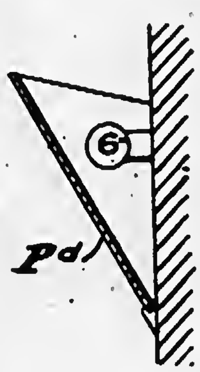


Fig. 29

Fig. 27

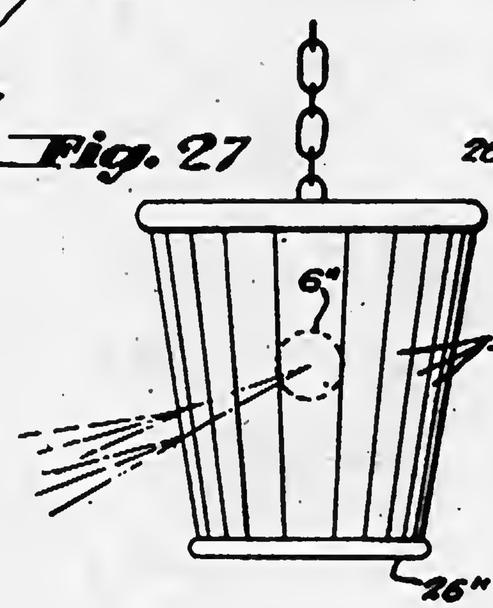


Fig 32

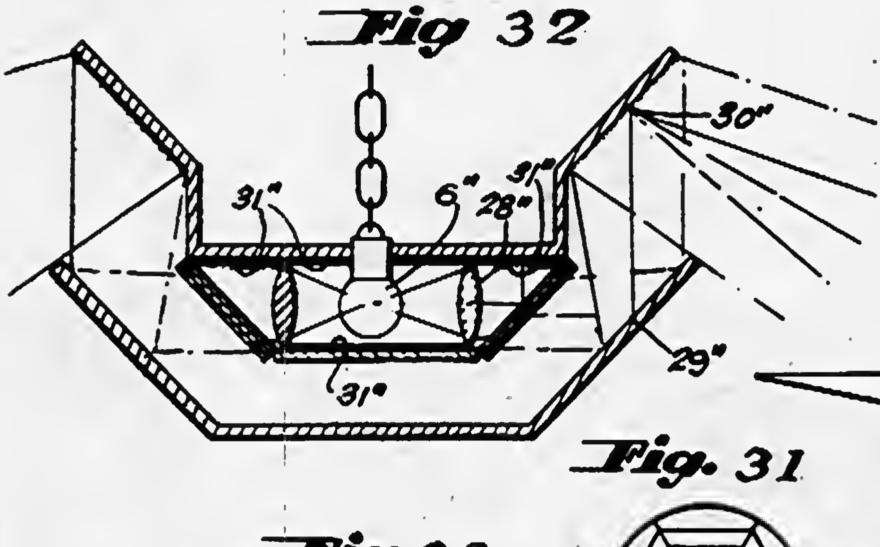


Fig. 30

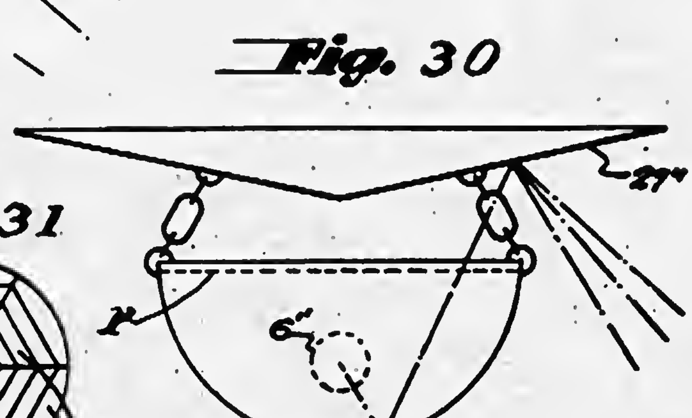


Fig. 31

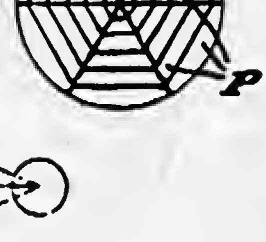
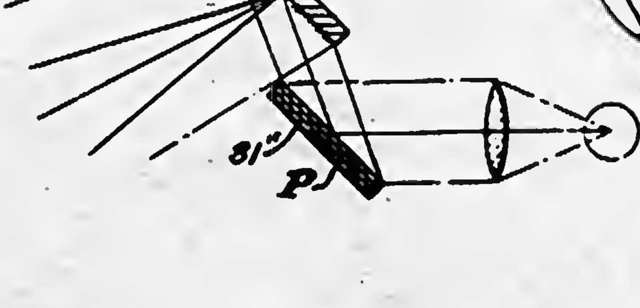


Fig 33



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Copy of Reference Lees, Article in "Discovery", August, 1921—pages 195-197.

(A) OLD PAINTINGS AND POLARISED LIGHT

How Ancient Paintings, Dark with Age and Patina, can be viewed in all their Pristine Freshness, without Restoration—A Parisian Scientist's Discovery

By George Frederic Lees

Time is sometimes credited among connoisseurs with having added to the beauty of oil paintings by the Great Masters. The pigments and mediums, with which they
77 were painted, darken in the course of centuries, largely owing to the action of light and atmospheric conditions upon them. Some of these works of art take on a patina, which is often said to enhance their beauty and value. But are we quite certain that this is so? Which would you prefer: a painting by, say, Raphael just as it is to-day, or the same work exactly as it was when the Master put the finishing touches to it, when it appeared in all its pristine freshness? The majority of people would, I believe, vote in favour of the masterpiece as it appeared to the eyes of the painter and his contemporaries, and would regret that it is no longer possible to see the work as it was in its original state.

Are we quite certain, however, that it is impossible to do this? Cannot science help us to see through the dust and
78 incrustations with which ancient pictures are covered, and to behold the colours as they left the artist's brush? . . . These were questions which a Parisian scientist, M. Pierre Lambert, asked himself in the course of experiments at the Sorbonne; and whilst seeking for one discovery he unexpectedly made another which has permitted him to answer those questions in the affirmative. The members of the Academy of Science, headed by M. Lippmann, have just

witnessed these experiments in M. Lambert's laboratory, and one and all were very much impressed.

A picture may be regarded as made up of two parts. There is the paint forming the picture itself, and there is the varnish covering the brushwork. Now the light reflected by the picture is reflected not only from the painting itself, but also from the varnish. If the latter be perfectly flat and polished, and if the observer place himself in a good position he may see the picture properly. But the surface of an old picture is generally irregular, full of little hills and dales, and even under the most favourable conditions of lighting the light reflected by the surface usually interferes in a remarkable manner with the reflec- 80
tion from the painting itself. It is therefore impossible to place oneself completely out of the reach of the reflections from this irregular surface which interfere so greatly with the effect expressed by the painter. If, therefore, a method could be devised by which the person viewing the picture could see it without his view being interfered with by this

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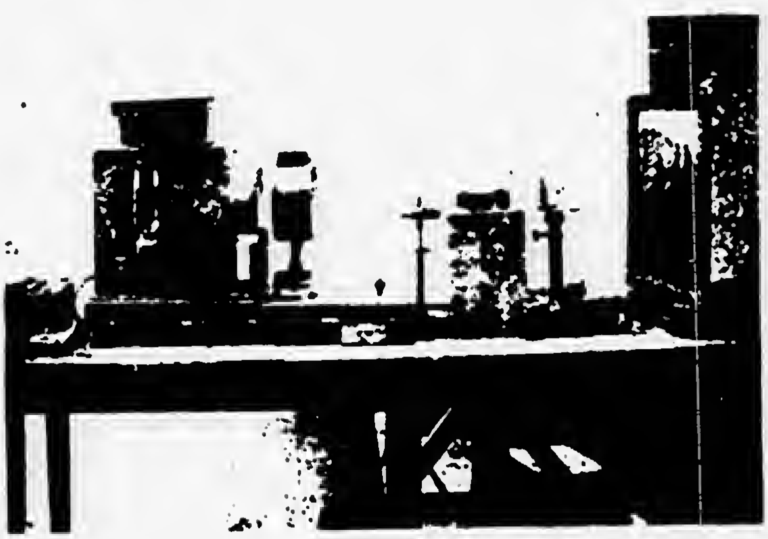

FIG. 1. THE APPARATUS USED FOR PROJECTING POLARISED LIGHT ON TO OLD PICTURES.

surface-effect, it would enable the person to see the picture as it was when it was first painted or as it would be if it were properly restored. By means of his polarised-light apparatus M. Lambert has made this possible.

A word now on polarised light. Ordinary light, such as sunlight or electric light, consists of transverse vibrations, the vibrations taking place in all directions at right angles to the direction of the rays. There are certain bodies, however, such that when light is passed through them the transverse vibrations all take place parallel to one definite direction only. The ray of light is then said to be *plane-polarised.*

83 The usual means of obtaining plane-polarised light is by means of a prism called a Nicol's-prism, which is made from a crystal of Iceland Spar (calcium carbonate). A Nicol's-prism may be used not only for producing polarised light (when it is called a polariser), but also for determining the plane in which the light is polarised, when it is said to be used as an analyser.

Let us consider the Nicol's-prism as an analyser. If the light falling on the Nicol be *unpolarised,* the intensity of the light which will get through will remain the same when the prism is rotated round the light ray as axis. If the light be polarised, however, the intensity of the light varies from a maximum to zero as the analyser is rotated. It is not hard to understand, therefore, that if a mixture of polarised and unpolarised light fall on the analysing prism,
84 it is not a matter of difficulty to rotate it so that the unpolarised light alone gets through—i.e. if the eye looks through the prism, only the unpolarised light is seen by the observer. When the analysing Nicol is so rotated that none of the polarised light gets through, it is said to be in the position of extinction. But, of course, even in the position of extinction the unpolarised light passes through the

 85

Nicol's-prism and is seen by the observer. It is these facts which are made use of by M. Lambert.

His method is to light up the picture under examination by polarised light and then to examine it through a Nicol's-prism. Under these conditions the light reflected by the surface, being for the most part polarised, is entinguished by the Nicol's-prism when it is held in the position of extinction, whilst the light passing through the varnish is depolarised by diffusion on the surface of the matter composing the colours and, being unpolarised, reaches the eye through the prism. In this way an observer sees the painting itself.

The apparatus consists of a source of intense light, an 86
arc or incandescent lamp with a low voltage. This light is enclosed in a lantern, provided with a condenser, followed by a lens destined to make the rays parallel during their passage through the polarising apparatus (a Nicol's-prism). A diverging lens then enlarges the pencil of luminous rays and lights up the entire picture, the plane of which is almost normal to the axis.

"Although this position is very disadvantageous under ordinary conditions," the inventor has explained, "the observer, looking through the Nicol's-prism, is able by slightly turning the instrument in his hand to find a position in which the superficial reflections are completely suppressed. In this way, as you will see, an old and dull-looking picture becomes perfectly distinct and full of vigour; its surface appears to have been restored; colours become more in- 87
tense, and details which do not attract the attention seem to assume the value they had when the work was painted."

The first picture to be submitted to the action of polarised light and then viewed through the Nicol's-prism by one

89

FIG. 2.—POSITION OF THE OBSERVER WHEN LOOKING AT AN OLD PICTURE THROUGH A NICOL'S-PRISM.

member of the Academy after the other was an old portrait of Gabrielle d'Estrées, a work contemporary with that fair lady and therefore black with age. All that could be distinguished on this little medallion portrait were the faint outlines of a woman's head and bust, slightly *décolletée*. Here and there were faint outlines of things which the artist had carefully drawn and coloured—details so obscured by Time that one could hardly tell what they represented. But once the canvas was set up, flooded with light
90 in the darkened laboratory, and viewed through the prism, everything down to the slightest particular and touch of colour was restored to pristine freshness. The writer was able to count the jewels in a magnificent ornament at the lady's waist; he could see every lock of her hair, almost every hair of the pretty curl which caressed her bosom; her eyes became as living to him as they were to her contemporaries.

 91

An old picture of a bouquet of flowers was transmitted in a similarly marvellous manner. This particular work was in so advanced a stage of obliteration that the flowers seemed to be suspended in mid air above a table. But on being illuminated and viewed through the Nicol's-prism everything sprang into being, with all the freshness of colour given to the still-life subject on the day it left the painter's studio. The flowers—roses, honeysuckle, and other species all easily distinguishable—were seen to be in a dark green glass bowl, partly filled with water, the transparency of which was really admirably depicted.

A number of landscapes were next examined, and in each
case they appeared to the eye as though they had just 92
passed through the hands of an expert restorer.

"What an admirable aid to the restorer of works of art!" was the reflection made by more than one of M. Pierre Lambert's guests. And someone voiced the thought.

"Yes," replied the physicist, with his customary modesty. "But for that I should not have taken the liberty of troubling you to see the application of a phenomenon which is well-known to us. It does seem to me that this method may be of use to connoisseurs who wish to judge of the artistic value of old paintings and to determine whether a given work is susceptible of being improved by modifying its varnish."

Let me say, in conclusion, that M. Lambert has invented
an accessory to his lantern—a V-shaped Nicol's-prism
binocular—which advantageously replaces the single tube 93
prism, since it dispenses with any turning of the prisms to the "position of extinction," whilst the arms can be placed at angles to suit all eyes.

94 Copy of Reference Preston, "Text on Theory of Light", 1895.

165. Polarisation by Reflection—Biot's Polariscope.—The polarisation of light was first noticed by Huygens when studying the refraction of light through a crystal of Iceland spar, but it remained an isolated fact in science for more than a century afterwards. About 1808 Malus discovered, accidentally, that light when reflected from the surface of glass acquires properties similar to those possessed by the light transmitted through a plate of tourmaline—that, in fact, light may be polarised by reflection,—and pursuing the inquiry further, he found that the same occurs when light is reflected from water and other transparent substances. Hence the two-sidedness of the light
95 which has passed through a tourmaline plate may be detected by allowing it to fall upon a plane glass plate. By turning the plate round the beam the reflected light is seen to vary in intensity, and in one position of the plate the reflected light vanishes altogether. By keeping the glass plate stationary and rotating the tourmaline we may obtain the same results.

Similarly the beam may fall first upon the glass and afterwards be transmitted through the tourmaline with the same effect. In one case we *polarise* the light by transmission through the tourmaline and *analyse* it (that is, detect its polarisation) by reflection from the mirror, and in the other case it is polarised by reflection from the mirror and

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Fig. 18.

analysed by transmission through the tourmaline. It is clear, therefore, that the tourmaline may be dispensed with altogether and replaced by a plane glass mirror, since the mirror can act the part either of a polariser or an analyser. On this principle instruments termed *polariscopes* have been constructed. One of the first of these was designed by Biot,[1] but it has long since been superseded by more commodious forms. It is represented in Fig. 148. At each end of a tube T plane mirrors of polished black glass are placed. Each mirror is capable of two motions—one round a diameter of the tube—that is, round an axis perpendicular to the axis of the tube. The amount of this rotation is
measured by the graduated circles M and N. The second 98
motion is round the axis of the tube. This is obtained by the mirrors being attached to rings G, H, which are graduated and movable on the tube.

The mirrors can thus be inclined at any angle to the incident light and to each other.

166. Angle of Polarisation.—When the planes of the two mirrors are placed parallel, the light which is reflected from the first and falls upon the second is, for a certain incidence, entirely reflected there. By rotating either mirror round the axis of the tube, the amount of reflected light will diminish and become a minimum when the mirror has been rotated through 90°, so that the mirrors are crossed. The amount of light reflected in this position will depend
upon the angle of incidence, and for one particular value 99
of this angle the reflected light will vanish entirely.

We consequently infer that there is one particular angle of incidence at which light is completely polarised by reflection from glass, and this is termed the *angle of polarisation*, or the *polarising angle.*

[1] Biot, *Traité de Physique,* tom. iv. livre sixième, chap. i. p. 255.

100

When light is reflected from glass, the reflected beam in general is only partially polarised. It cannot be completely extinguished by a tourmaline plate or by reflection from another mirror at any incidence. The amount of polarisation depends upon the angle of incidence, and at one particular angle the polarisation becomes complete.

We must not hastily infer that for every substance there is an angle of complete polarisation. In fact, it is proved by experiment that as the angle of incidence increases, the polarisation in general also increases to a maximum, and then decreases after passing through the angle of maximum polarisation. For each substance there is an angle of incidence which gives a maximum of polarisation, and this
101 angle is termed the *polarising angle* of the substance.

M. Jamin, who investigated this subject, found that only a few substances, of refractive index about 1.46, polarise light completely by reflection. For all other substances the polarising angle is merely the angle of maximum polarisation. For glass the polarising angle is about 57°, and for pure water 53° 11′.

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103

Copy of Reference Lowndes British Patent No. 177,948.

COMPLETE SPECIFICATION.

Improvements in Optical Instruments.

I, Ashley Gordon Lowndes, M.A., A.I.C., of Marlborough College, Wilts, Assistant Science Master, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the improvement of spectacles
used for the observation of objects submerged below the 104
surface of water.

It is well known that the continued observation of objects placed below the surface of water, on account of the reflected light and the glare produced thereby, is if not actually injurious to the eyes, at least a very tiring process.

Now when observing such objects placed below the surface of the water light from two distinct sources reaches the eye. Light is transmitted directly from the object and light is reflected from the surface of the water.

The reflected light differs from the transmitted light in that it is very largely polarised.

If therefore a sheet of tourmaline is interposed or placed in the path of the reflected rays, that part of the reflected rays that is polarised can be almost completely obliterated
by the polarising effect of the tourmaline. 105

It is therefore possible to separate the transmitted light from the reflected, and hence the object to be observed can be seen much more plainly.

To obtain the maximum effect the tourmaline must be cut and orientated in accordance with the laws of crystal optics.

In one pair of pectacles in which I use my invention I take an ordinary pair of spectacles and replace the lower part of both lenses by a plate of tourmaline which is cut parallel to the ortho-axis, and placed in such a way that the plane of vibration of the light transmitted by the tourmaline is at right angles to the plane of vibration of the polarised light after reflection at the reflecting surface.

The tourmaline has in this case the additional advantage of absorbing the reflected light in such a way that the glare from the water is practically obliterated.

As an alternative, the whole of the lenses can be replaced by plates of tourmaline, or the tourmaline can be superimposed upon the lenses, or incorporated in them so that it does not impair their ophthalmic value.

107 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

The use of tourmaline for making spectacle lenses which render objects below the surface of water much more visible by the elimination of the reflected light by the polarising properties of the tourmaline, the lenses in spectacles being partly or completely replaced by the tourmaline, or the tourmaline lenses being mounted on the glass lenses.

Dated the 22nd day of November, 1921.

Ashley Gordon Lowndes.

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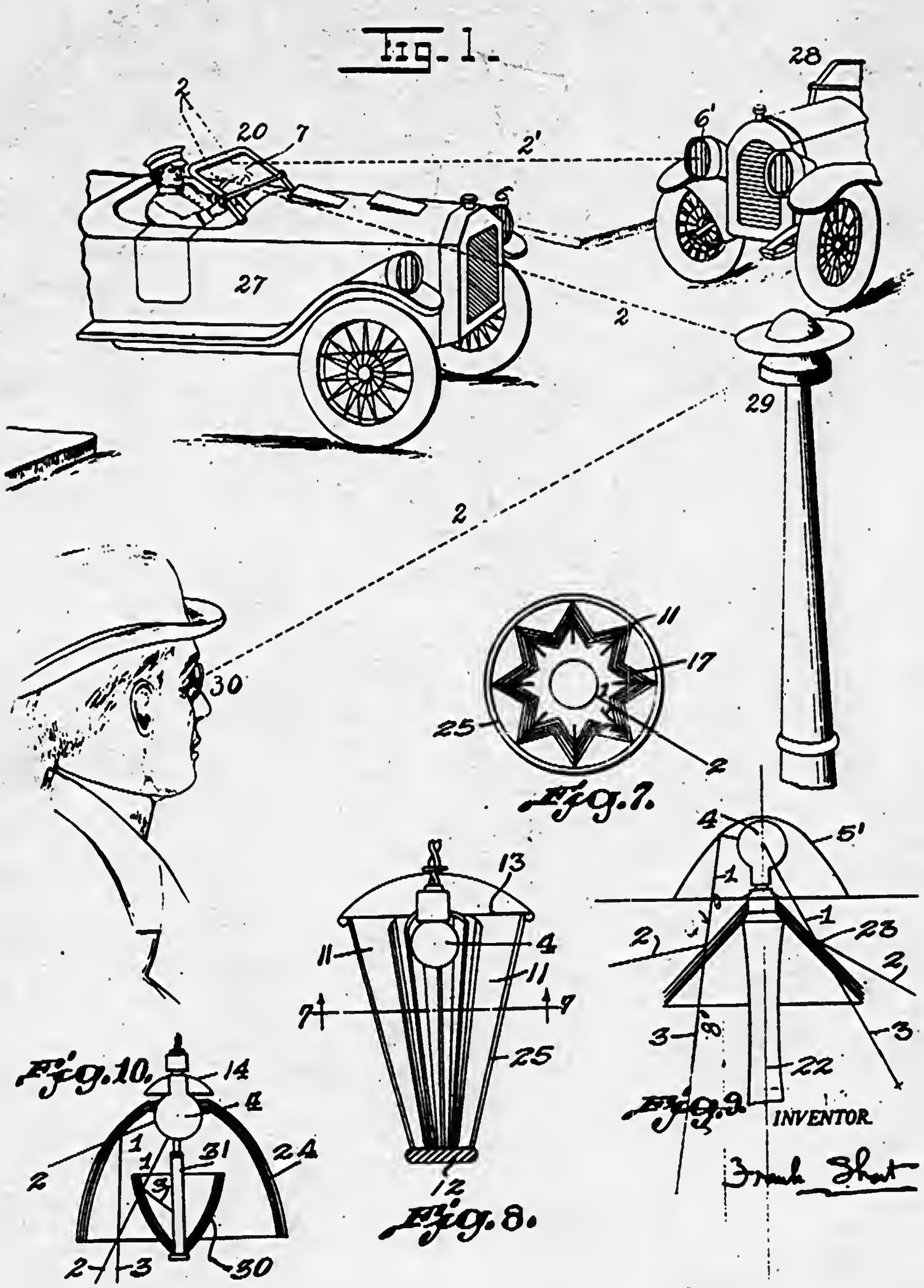
Copy of Reference Short U. S. Patent No. 1,733,915.

(Bound in opposite)

Oct. 29, 1929. F. SHORT 1,733,915

ILLUMINATING APPARATUS AND PROCESS

Filed April 23, 1924 3 Sheets-Sheet 1



~~tan~~

$\sin\theta = \frac{5}{40} = \frac{1}{8} : .125$

$\theta = 7^\circ - 8^\circ$

Oct. 29, 1929. F. SHORT 1,733,915

ILLUMINATING APPARATUS AND PROCESS

Filed April 23, 1924 3 Sheets-Sheet 2

Fig. 2.

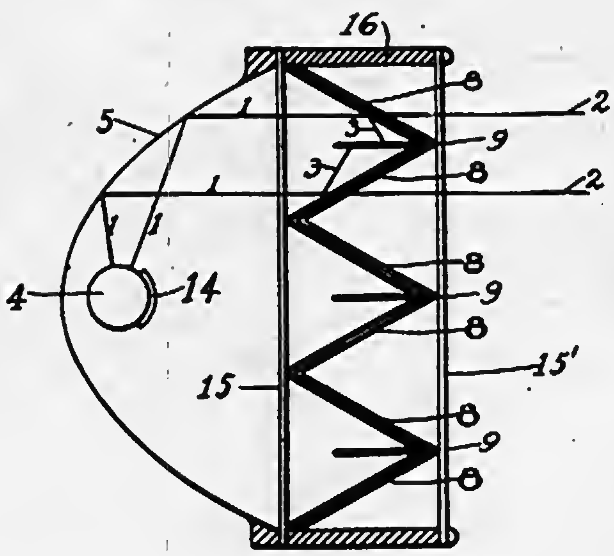
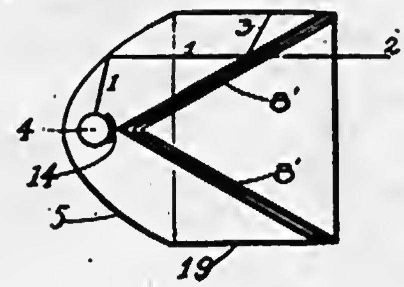


Fig. 5.



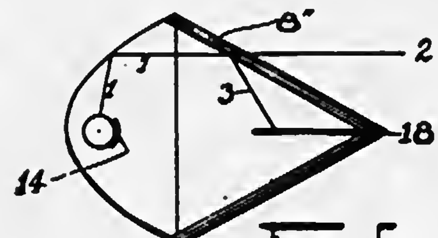
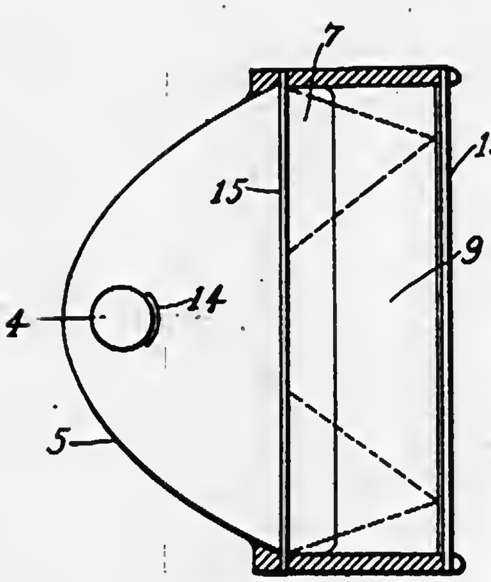


Fig. 6.



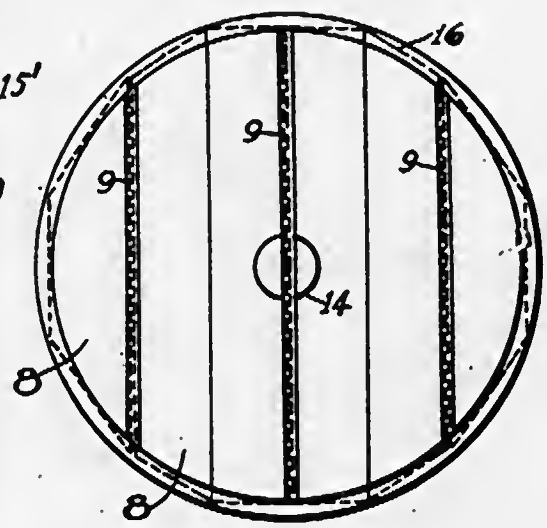


Fig. 3. Fig. 4.

INVENTOR.

Frank Short

Oct. 29, 1929. F. SHORT 1,733,915

ILLUMINATING APPARATUS AND PROCESS

Filed April 23, 1924 3 Sheets-Sheet 3

Fig. 14

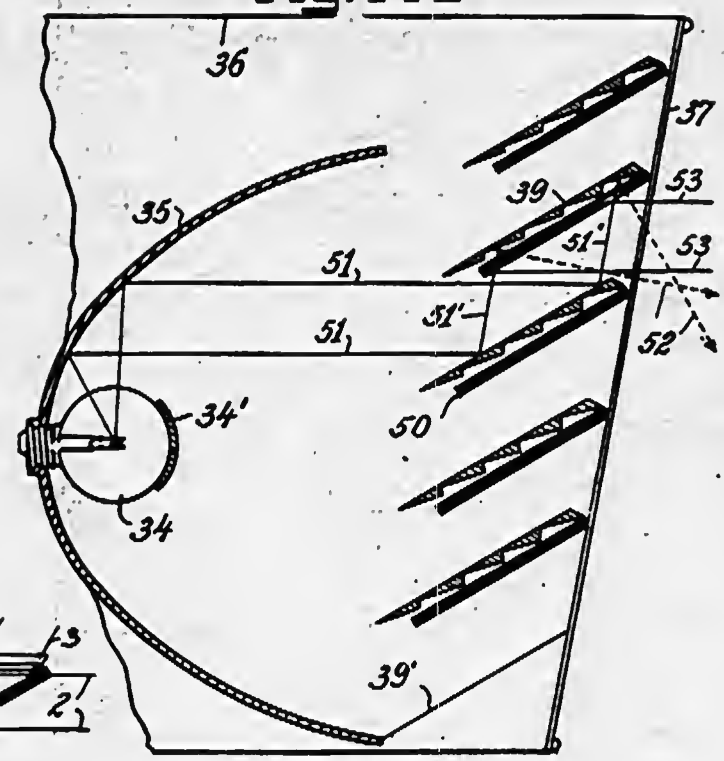


Fig. 15

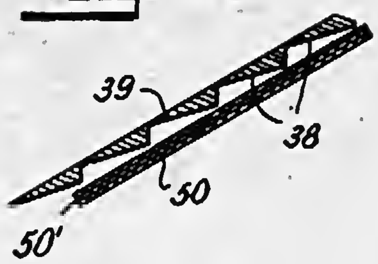


Fig. 12

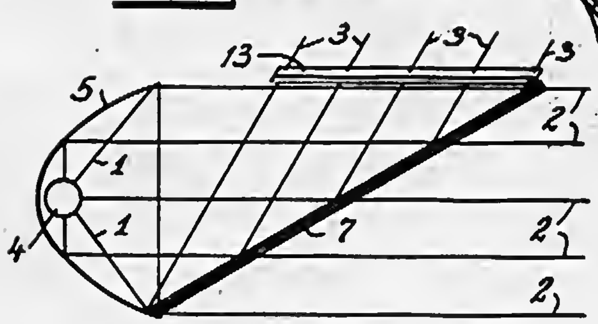


Fig. 13

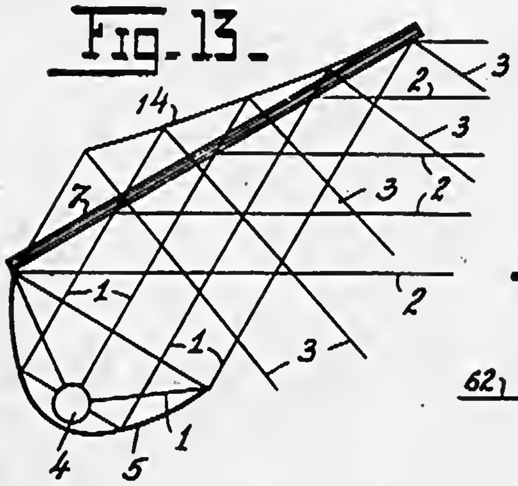
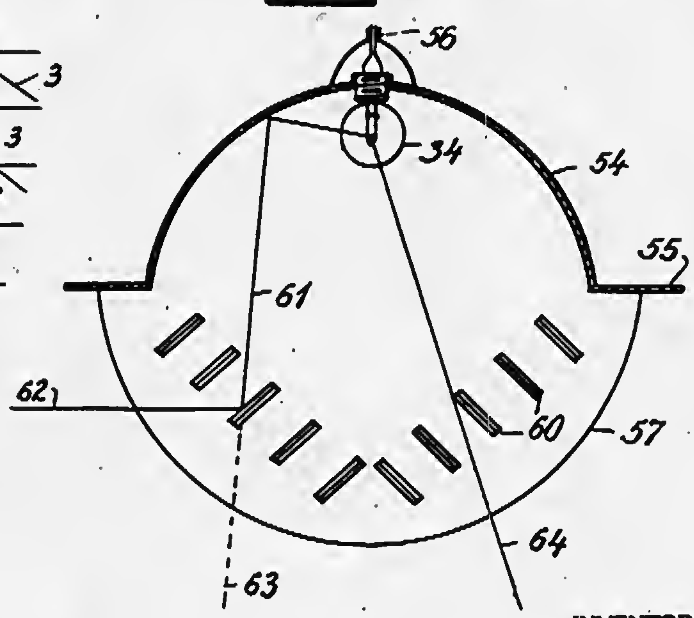


Fig. 11



INVENTOR

Frank Short

Oct. 29, 1929. F. SHORT 1,733,915

ILLUMINATING APPARATUS AND PROCESS

Filed April 23, 1924 3 Sheets-Sheet 2

Fig. 2.

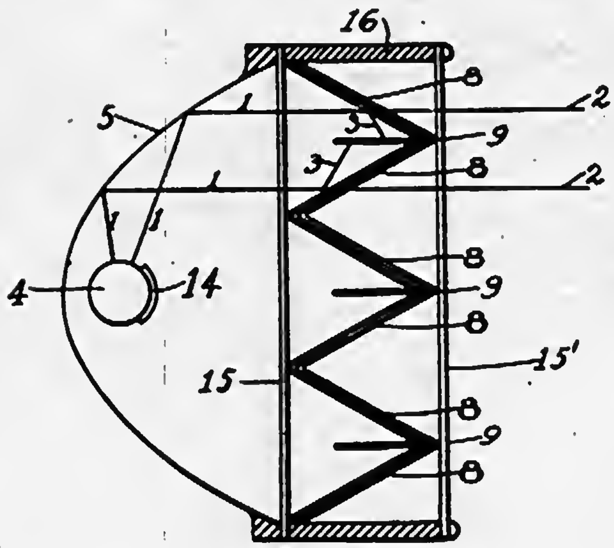
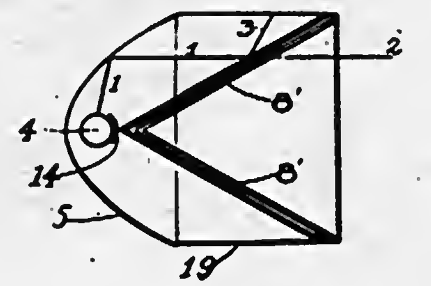


Fig. 5.



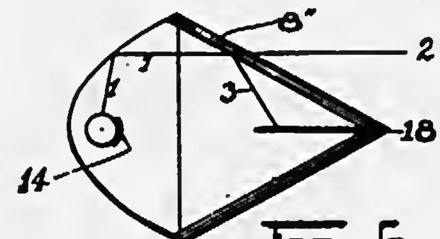
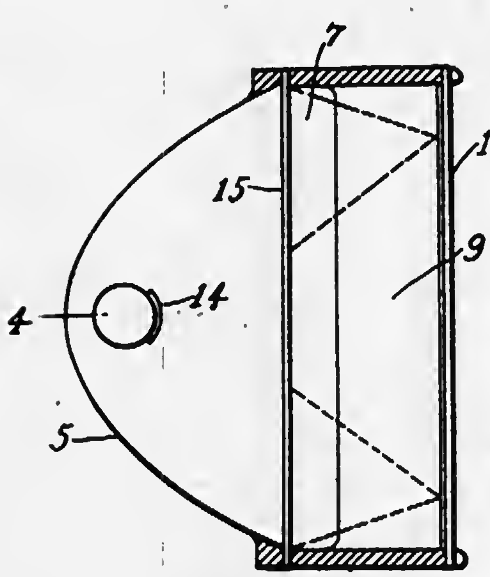


Fig. 6.



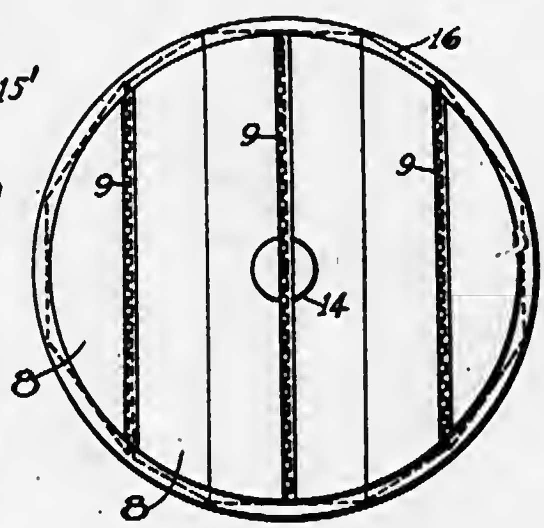


Fig. 3.

Fig. 4.

INVENTOR.

Frank Short

Oct. 29, 1929. F. SHORT 1,733,915

ILLUMINATING APPARATUS AND PROCESS

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Fig. 14

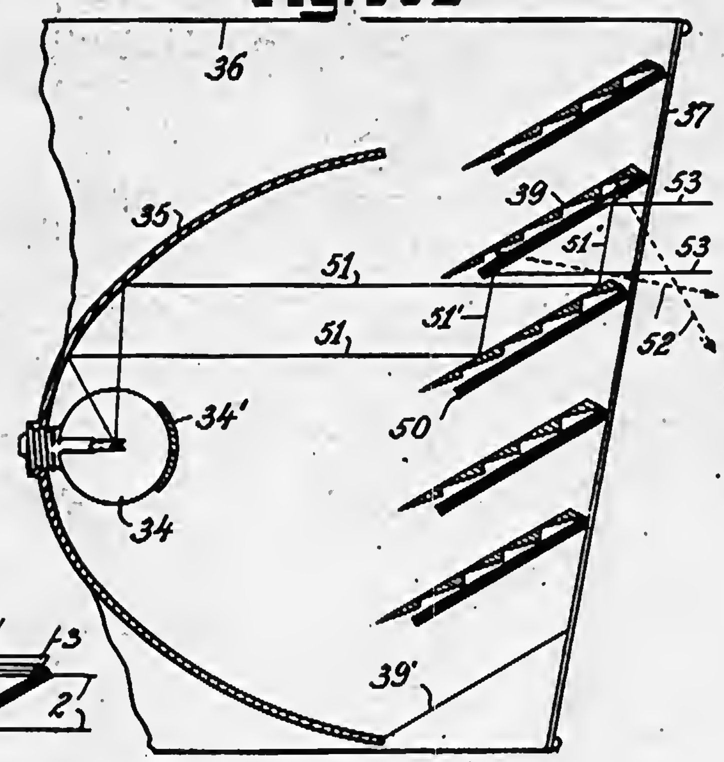


Fig. 15

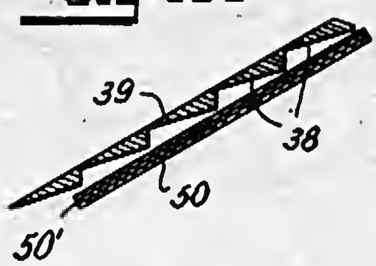


Fig. 12

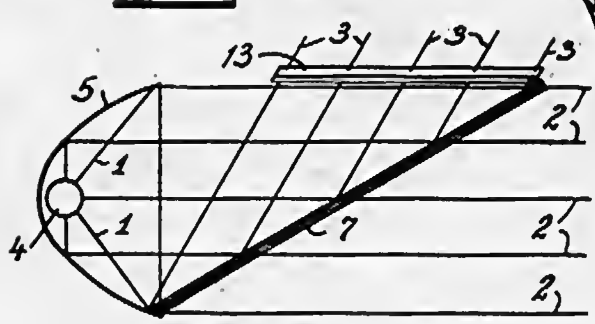


Fig. 13

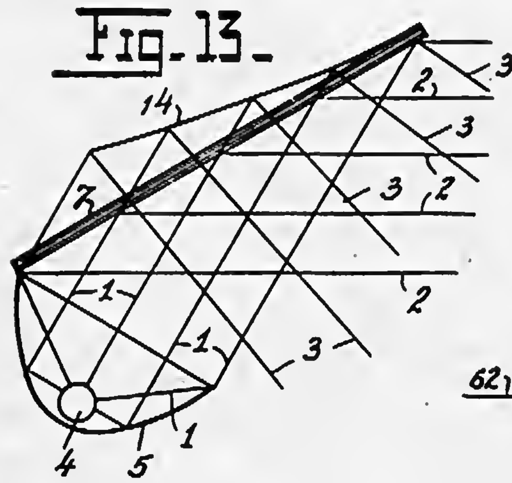
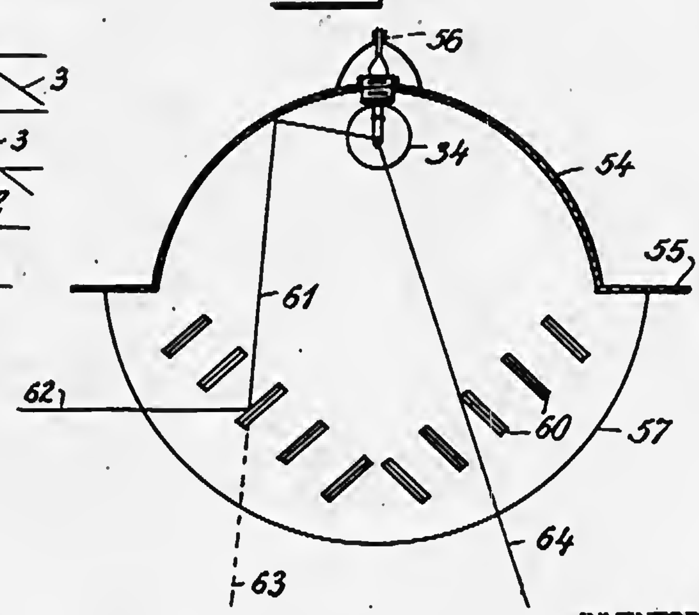


Fig. 11



INVENTOR

Frank Short

Patented Oct. 29, 1929 1,733,915

UNITED STATES PATENT OFFICE

FRANK SHORT, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO JOHN J. SERRELL, OF ELIZABETH, NEW JERSEY, AND ONE-HALF TO ROBERT A. SMITH, OF MAHWAH, NEW JERSEY

ILLUMINATING APPARATUS AND PROCESS

Application filed April 23, 1924. Serial No. 708,563.

This invention relates particularly to polarized light illuminating apparatus and processes of using the same in connection with street lighting and automobiles and other vehicles so that the glare of street lamps or vehicle headlights can be cut out by the drivers of other vehicles or pedestrians or other persons who are provided with polarized light viewing devices adapted to cut out the vertically or otherwise polarized light sent out therefrom. At the same time, such polarized light from headlights or street lamps when it strikes ordinary road objects is sufficiently depolarized or irregularly polarized or changed so that such road objects, even though illuminated by polarized light, then reflect or transmit ordinary light or other components which makes these objects visible through polarized light viewing devices which are adapted to largely or completely cut out the vertically polarized light, for instance, which illuminates these road objects.

Any suitable light polarizing devices may be used for such street lamps or automobile headlights and for practical and commercial reasons superimposed piles or series of glass plates or other transparent films or layers of non-crystalline material such as thin cellulose or gelatine films, for instance, have decided advantages since the reflected beams of light from such multiple thickness plates of glass, etc. when sufficient numbers are used, may be substantially plane polarized so as to be effective for these purposes. The other component of the light which is transmitted through such multiple plates or films, and which is more or less polarized in the complementary or transverse plane, may be used for various purposes such as illuminating the ground adjacent the base of a street lamp, for instance, or illuminating the road closely adjacent the headlight or spotlight of an automobile, in addition to the substantially horizontally directed beams of polarized light which are used for specific road illumination. It is of course understood, however, that other polarizing devices may be used for such light emission and for some specific purposes special forms of prisms or crystals or compositions may be used as light polarizing means. In connection with such polarized light emission devices various types of polarized light viewing devices may be used comprising polarizing prisms or crystals of various types or where large area viewing devices are desired multiple plates of glass or other suitable material may be used with advantage, and for this purpose and for light emitting devices these multiple glass plates of thin plate or other preferably thinner glass may be advantageously united as by fusing or cementing some or all of their edges together as by vitreous material so as to prevent undesirable working and scratching and enable the glass plates to more or less reenforce and strengthen each other under service conditions and also to exclude dust and other undesirable material.

In the accompanying drawings showing in a somewhat diagrammatic way various illustrative embodiments of this apparatus and ways of carrying out these processes

Fig. 1 is a diagrammatic perspective view showing street lamps and automobile headlights in connection with viewing devices.

Fig. 2 is a diagrammatic horizontal cross section through one type of headlight or other concentrated beam light emission device.

Fig. 3 is a corresponding vertical section thereof taken approximately through the center of Fig. 2 and perpendicular to plates 15, 15′.

Fig. 4 is a front view of the same.

Figs. 5 and 6 are diagrammatic horizontal sections of other light emission devices of similar type.

Fig. 7 is a horizontal diagrammatic section through a street lamp or other illuminating device taken substantially along the line 7—7 of Fig. 8.

Fig. 8 is a corresponding vertical section thereof.

Figs. 9, 10 and 11 are diagrammatic vertical sections showing other form of street lighting devices.

Figs. 12 and 13 are horizontal diagrammatic sections showing different types of searchlight or spotlight emission devices for vehicles, etc.

Fig. 14 is a vertical diagrammatic section through another headlight, and

Fig. 15 is a sectional detail thereof.

As indicated somewhat diagrammatically in Fig. 1, polarized light street lamps may be advantageously used in many cases, particularly at intersecting motor routes and the street lamp 29 is shown mounted at such a street intersection so that it can send out in some or all directions substantially horizontally directed beams of light 2 which may be polarized in any desired direction as, for instance, by being vertically polarized by means which will be subsequently described in greater detail. It is also desirable to have automobiles and other vehicles which are provided with strong headlights, spotlights or other lights directed along the road so arranged that these powerful lights will emit plane polarized light which is advantageously polarized in the same plane as the street lamps so that, for example, the headlights 6′ on the automobile 28 may be equipped with polarized light emission devices adapted to emit reflected or transmitted beams of light 2′ which are polarized in a vertical plane, for instance, where the street lamp 29 emits such vertically polarized beams of light. While these vertically polarized beams of light are effective in illuminating road objects or vehicles, the objectionable and confusing glare of such direct beams of polarized light may be prevented by using any suitable form of polarized light viewing devices which are adapted to wholly or largely cut out light which is polarized in such a vertical plane, for example. It is of course advantageous to have such polarized light viewing devices mounted adjacent the operator of an automobile and for this purpose a multiple glass plate viewing device 7 may be mounted on or may constitute the windshield 20 so as to cut out or divert by reflection upward the directly transmitted beams of vertically polarized light 2 and 2′ so as not to confuse the operator's vision or prevent him from seeing the road objects or obstacles which may be illuminated by the light from his own similarly polarized light headlights 6, for example, or by any other source such as the street lamp 29. Other persons in the neighborhood who may be looking toward or approaching such street lamps or vehicle headlights may advantageously be provided with suitable polarized light viewing devices which may be multiple plates mounted adjacent windows of neighboring houses or arranged in the form of spectacles or made up in eye shield type and attached to a person's hat, headgear or wearing apparel in some instances, and Fig. 1 shows a pedestrian's spectacle type of polarized light viewing device 30 which may be of crystal, prism, or multiple transparent plate form arranged at such an angle as to largely or wholly cut off the vertically polarized beams of light, for example, which might tend to confuse such a person, particularly at a busy automobile corner.

An illustrative form of light emission device which may be used for headlights or spotlights for automobiles, etc., is shown in Figs. 2 to 4 as comprising a source of light such as a concentrated filament electric lamp 4, for instance, which may be mounted in the focus of a parabolic reflector 5, a shield 14 being preferably arranged in front of the lamp so as to cut out direct rays therefrom and thus secure a bundle of substantially parallel forwardly directed rays 1 which may be polarized by suitable means such as bundles or piles of plates of glass or other suitable material which may be arranged in V-form across the front of the lamp and supported between two protecting plates 15, 15′ of glass etc. which may be mounted in the housing 16 in any suitable way which it is unnecessary to show or describe in detail. Piles or packs of thin plates or filaments of glass, cellulose acetate or other material may be angularly arranged on either side of light absorbing screens 9 of blackened metal, for instance, which project inwardly for a considerable distance at least between the angularly arranged piles of plates so as to absorb the reflected beams of light 3 in this instance while allowing the transmitted beams 2 which pass through the multiple plates 8 and thus become more or less polarized, so as to be used when projected forward along the path of an automobile or other vehicle, for example. Any desired number of such V-shaped multiple plates may be used in connection with the headlight or other lamp and as shown in Fig. 2, three such V-shaped piles of plates with an interposed screen may be used; or, as shown in Fig. 6, a single V-shaped arrangement of plates 8″ of glass or other material may constitute the front of the headlight in some cases in connection with an interposed light absorbing screen 18. Fig. 5 shows somewhat diagrammatically another illustrative arrangement of V-shaped multiple plates in which the V-shaped pair of multiple plates are in this instance directed inwardly toward the lamp 4 so that the reflected rays 3 are in this case directed outward toward the inner surface of the casing 19 which may be blackened or otherwise treated so as to act with the desired efficiency as a light absorbing medium.

Other illustrative forms of lights for automobiles or other vehicles in which multiple plates are used for polarizing purposes are shown diagrammatically in Figs. 12 and 13 in which in this instance a single multiple plate or pile of thin glass or other non-crystalline sheet material 7 is mounted at the desired polarizing angle with respect to the forwardly directed light beams 2 which thus become polarized, the transmitted beams passing through these multiple plates being polarized in one direction, in the plane transverse to the paper in Fig. 2. The reflected beams of light 3 are of course polarized in the transverse direction and these reflected beams of polarized light which are in many cases more thoroughly or perfectly polarized, may be used as the forwardly directed beams of light as by passing the same through a plate of glass or other material 13 so that they can then be directed along the path of the automobile or other vehicle. If desired, however, these reflected rays may be directed laterally and downward toward the side of the road so as to be used for local illumination while the transmitted polarized rays of light 2 may be directed ahead of the vehicle along the road in the case of automobile headlights, for example.

Fig. 13 shows another illustrative arrangement in which the parallel rays of light 1 from the reflector 5 may be directed upward at a suitable angle against the pile of plates of glass or other material 7 arranged at the proper polarizing angle so as to produce the reflected polarized beams of light 2 which may be directed forward along the path of the vehicle. The transmitted rays of light may in this case be used for lateral or local illumination and may, if desired, strike a curved or angularly arranged reflector surface 14 and thus be reflected back through the pile of plates 7 so as to form the somewhat diffused angular rays of light 3 which may be directed downward and sidewise for local illumination adjacent the vehicle.

Various forms of street lamps may be used for producing polarized light which may be sent out in one or more directions or more or less uniformly sent out radially throughout a horizontal circle for general illumination adjacent a motor route intersection as shown in Fig. 1. Figs. 7 and 8 show somewhat diagrammatically an arrangement by which polarized light may be produced for street lighting purposes by means of piles of thin plates of glass or other suitable material 17 which may be arranged at the desired angle on each side of an opaque light absorbing screen 11 so as to form V-shaped light polarizing multiple plates or units, any desired number of which may be used around the centrally located lamp from which the rays of light 1 radiate so as to produce transmitted rays 2 of polarized light. Such a lamp may, of course, be supported in any desired way and may have a hood or cover 13 by which it may be suspended in some cases while a bottom or supporting member 12 may be arranged below the multiple plates, if desired.

Fig. 10 shows diagrammatically another illustrative arrangement in which a number of layers of relatively thin glass or other suitable material 24 are given such shape in reference to the concentrated filament or arc light 4 that the beams of light 1 from this source always strike the multiple thickness plates at substantially the desired light polarizing angle so as to give substantially plane polarized transmitted rays 2 where a sufficient number of plates or layers are used, the other component 3 of the light which is reflected from the different layers of plates and which is of course polarized in the transverse or complementary direction, being directed downwardly in this instance below the street lamp which may be suspended or otherwise supported in any desired way. In some cases the full unchanged rays from the lamp may be allowed to pass downward throughout a relatively small arc or circle near the vertical axis of the lamp to more intensely illuminate traffic signals or the like, although in many cases it is desirable to have a multiple plate polarizing unit 30 through which these vertically directed rays pass at such angles as to plane polarize the transmitted rays 2 passing through these multiple plates while the reflected rays such as 3 may be more or less absorbed where a blackened or other absorbent support 31 of large size is used for this interior lower unit.

Another type of street lamp which is in some respects more desirable is illustrated diagrammatically in Fig. 9 as comprising a parabolic reflector and hood 5′ within which the intense filament lamp 4 may be mounted so as to form downwardly reflected rays which may be directed substantially vertically or preferably at slightly divergent angles as indicated so as to impinge upon the multiple plate polarizing unit 23 which may consist of a conical or pyramidal arrangement of the desired number of layers of thin glass or other suitable transparent polarizing films or plates 23 so as to give substantially plane polarized reflected rays 2 which may be directed more or less horizontally while the transmitted rays 3 which pass through these multiple plates and which are more or less polarized in the transverse direction are directed downward adjacent the base of the street lamp which may be supported on the pillar 22.

Fig. 11 shows diagrammatically another somewhat similar type of street lamp comprising a substanatially parabolic reflector 54 which may serve as the lamp hood and be provided with suitable suspension means 56 and arranged so that a concentrated filament lamp 34 or arc arrangement, if desired, may be mounted at the focus of this reflector so as to produce substantially downwardly directed rays 61. A series of multiple plate polarizing elements 60 may be mounted below this reflector so as to be in the path of the light rays therefrom and these polarizing elements which may be made up of six or more superimposed thicknesses of thin glass or other suitable transparent material may be of generally conical or pyramidal form where the resulting reflected substantially plane polarized rays of light 62 are to be sent out in a number of directions. Where the light is only needed in two opposite horizontal directions along a single stretch of substantially straight road, the polarizing elements may be straight and are, of course, in all these cases mounted in suitable metallic or other supports so as to be held securely at the desired polarizing angle for the particular substance of which the plates are composed. These elements may also be advantageously enclosed and protected by a hemispherical glass globe such as 57 which may be secured to the rim 55 of the hood. The transmitted rays passing through these multiple plate polarizing elements 60 may extend downward more or less vertically as at 63 and, if desired, the width and positioning of the polarizing elements may be such as to allow some of the direct radial beams of light 64 to pass between them to more intensely illuminate the ground below the street lamp.

Fig. 14 shows diagrammatically a desirable form of searchlight or spotlight for automobiles or other vehicles in which a parabolic reflector such as 35 may be mounted within a cylindrical or other metallic casing 36 so that a concentrated filament lamp 34 which may have a front shield 34′ may be mounted in the focus of the reflector so as to produce substantially parallel beams of light 51 which may be directed forwardly along the path of the vehicle. In the path of these parallel rays are mounted a series of inclined multiple plate polarizing elements 50 having metallic reflector strips mounted adjacent their upper surfaces so that the flat tops 39 of these reflector strips and the separate reflector plate or strip 39′ at the bottom reflect the light rays upward as at 51′ against the multiple plate polarizing element 50 above so as to produce substantially plane polarized forwardly reflected beams of light 53 while the transmitted light passing through all of the multiple plates 50 may be absorbed if the lower surface of these reflector or backing strips 39 is of black or other absorbent material or surface, as is desirable in some cases. As shown more in detail in Fig. 15, however, it is sometimes desirable to have these reflector strips formed with saw-tooth or stepped lower faces 38 next the multiple plate polarizing elements so that the refracted beams of light may be reflected backward at a greater downward angle through the multiple plates so as to be directed as at 52 toward the adjacent road surface for local illumination near the front of the automobile or other vehicle. A series of these reflector backed multiple plate polarizing elements may be mounted across the front of the headlight at such angles as to secure the proper polarizing action of the plates of glass or other material used and they should be spaced closely enough together so as to intercept all of the forwardly directed parallel beams of light from the parabolic reflector for which purpose the metallic or other reflector strip 39 may, as indicated in Fig. 15, extend past the lower edges of the multiple plate polarizing elements. These reflector strips may be rolled or otherwise formed of any suitable metal such as speculum metal, for instance, or nickel-plated brass may be used, if desired, or in some cases saw-toothed or otherwise corrugated strips of glass, which may have ground or other fairly flat upper surfaces, may be used for these reflector strips after applying silver or other reflecting coatings thereto where uniform expansion is of particular importance. In some cases it is advantageous to fuse or cement together one or more edges of the multiple glass or other transparent plate polarizing elements and this may be done by suitable local heating of the edges 50′ of the glass plates after the whole plates have been brought up to a substantial or high heat. Or vitreous fluxes or enamels, preferably of substantially transparent character, may be applied to the edges to facilitate this heat union of the plates and where cellulose or other transparent films or plates are used more or less fluent or plastic cementing materials may be applied to the edges of the plates and then slightly heated in some cases to the necessary extent to cause union or connection of the edges of the plates through these cements which are, of course of such composition as to adhesively unite the particular transparent plates used.

This invention has been described in connection with a number of illustrative embodiments, forms, proportions, elements, parts, materials and arrangements, orders of steps, methods of preparation and use, to the details of which disclosure the invention is not of course to be limited since what is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims.

I claim:

1. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing by reflection vertically polarized light sent out in a substantially horizontal direction and transmitting light partially polarized in the complementary plane substantially vertically downward adjacent the base of said street lamp, and a vehicle comprising a headlight having a source of light and cooperating polarizing devices producing vertically polarized light sent out ahead of the vehicle in the direction of travel of the vehicle, and polarized light viewing devices adapted to be mounted adjacent the operator of the

vehicle to substantially cut off vertically polarized light.

2. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing vertically polarized light sent out in a substantially horizontal direction, and a vehicle comprising a headlight having a source of light and cooperating polarizing devices producing vertically polarized light sent out in the direction of travel of the vehicle, and polarized light viewing devices adapted to be mounted adjacent the operator of the vehicle, to substantially cut off vertically polarized light.

3. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing polarized light sent out in a substantially horizontal direction, and a vehicle comprising a light having a source of light and cooperating polarizing devices producing similarly polarized light, and polarized light viewing devices adapted to be mounted adjacent the operator of the vehicle to substantially cut off polarized light.

4. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices comprising multiple layer thin glass plates producing by reflection from said source of light vertically polarized light sent out in a substantially horizontal direction, a vehicle comprising a light having multiple plate reflecting polarizing devices producing vertically polarized light sent out in the direction of travel of the vehicle, and polarized light viewing devices mounted on the vehicle adjacent the operator of the vehicle and adapted to substantially cut off such vertically polarized light.

5. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing vertically polarized light sent out in a substantially horizontal direction, a vehicle comprising a light having polarizing devices producing vertically polarized light sent out in the direction of the travel of the vehicle, and polarized light viewing devices mounted on the vehicle and adapted to substantially cut off such vertically polarized light.

6. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices comprising multiple layers of glass producing vertically polarized light sent out in a substantially horizontal direction, an automobile comprising headlights each having a source of light and cooperating polarizing devices producing vertically polarized light sent out in the direction of travel of the vehicle, and polarized light viewing devices adapted to be mounted adjacent the eyes of an approaching person to substantially cut off vertically polarized light.

7. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing polarizeed light sent out in a substantially horizontal direction, an automobile comprising headlights each having a source of light and cooperating polarizing devices producing such polarized light sent out in the direction of travel of the vehicle, and polarized light viewing devices adapted to be adjacent the eyes of an approaching person to substantially cut off polarized light.

8. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing vertically polarized light sent out in a substantially horizontal direction and transmitting light downward adjacent the base of said street lamp, and a vehicle comprising a light having a source of light and cooperating polarizing devices producing similarly polarized light, and polarized light viewing devices mounted adjacent the eyes of an approaching person and adapted to substantially cut off vertically polarized light.

9. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices producing polarized light, and a vehicle comprising a light having a source of light and cooperating polarizing devices producing similarly polarized light, and polarized light viewing devices mounted adjacent the eye of an approaching person and adapted to substantially cut off such polarized light.

10. In illuminating apparatus, an essentially completely hemispheric directional street lamp comprising a source of light and cooperating polarizing devices producing polarized light, and polarized light viewing devices mounted adjacent the eye of an approaching person and adapted to substantially cut off such polarized light.

11. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices comprising multiple layer glass plates producing polarized light sent out in a substantially horizontal direction, and transmitting light partially polarized in a complementary plane downward adjacent the base of said lamp, and a vehicle comprising headlights each having a source of light and cooperating multiple layer glass plate polarizing devices producing similarly polarized light sent out ahead of the vehicle in its direction of travel.

12. In illuminating apparatus, a street lamp comprising a source of light and cooperating polarizing devices, producing polarized light sent out in a substantially horizontal direction, and transmitting light partially polarized in a complementary plane downward adjacent the base of said lamp,

and a vehicle comprising headlights each having a source of light and cooperating polarizing devices producing similarly polarized light sent out ahead of the vehicle in its direction of travel.

13. In illuminating apparatus, a street lamp comprising a source of light and a cooperating downwardly directed substantially parabolic reflector and angularly arranged piles of thin glass plates below said reflector to produce reflected beams of vertically polarized light sent out in substantially opposite directions and adapted to be directed along a road, and to direct the transversely polarized component of light transmitted through said plates downward adjacent the base of said lamp, and a vehicle comprising piles of thin plates forming polarized light viewing devices mounted adjacent the operator of the vehicle to substantially cut-off such horizontally directed vertically polarized light.

14. In illuminating apparatus, a street lamp comprising a source of light and a cooperating downwardly directed reflector and angularly arranged piles of thin plates below said reflector to produce reflected beams of vertically polarized light sent out in substantially opposite horizontal directions and adapted to be directed along a road, and to direct the transversely polarized component of light transmitted through said plates downward adjacent the base of said lamp, and a vehicle comprising polarized light viewing devices to substantially cut off such horizontally directed vertically polarized light.

15. In illuminating apparatus, an essentially completely hemispheric-directional street lamp comprising a source of light and angularly arranged piles of thin plates to produce reflected beams of polarized light sent out in substantially horizontal directions and adapted to be directed along a road, and a vehicle comprising polarized light viewing devices to substantially cut off such horizontally directed vertically polarized light.

16. In illuminating apparatus, a street lamp comprising a source of light and a cooperating downwardly directed substantially parabolic reflector and angularly arranged piles of thin conical glass plates below said reflector to produce reflected beams of vertically polarized light sent out in substantially opposite horizontal directions and adapted to be directed along roadways, and to direct the transversely polarized component of light transmitted through said plates downward adjacent the base of said lamp.

17. In illuminating apparatus, a street lamp, comprising a source of light and a cooperating downwardly directed substantially parabolic reflector and angularly arranged piles of thin plates below said reflector to produce beams of vertically polarized light sent out in substantially horizontal directions and adapted to be directed along roadways, and to direct the transversely polarized component of light transmitted through said plates downward adjacent the base of said lamp.

18. In illuminating apparatus, an essentially completely hemispheric-directional street lamp comprising a source of light and a cooperating downwardly directed reflector and angularly arranged piles of thin plates below said reflector to produce beams of polarized light sent out in substantially horizontal directions and adapted to be directed along roadways.

19. In illuminating apparatus, a street lamp comprising a source of light and cooperating reflecting and polarizing devices comprising piles of thin plates to produce beams of vertically polarized light sent out in substantially horizontal directions and adapted to be directed along roadways, and to direct the transversely polarized component of light transmitted through said plates in different directions adjacent said lamp.

20. In illuminating apparatus, an essentially completely hemispheric-directional street lamp comprising a source of light and cooperating reflecting and polarizing devices comprising piles of thin plates to produce beams of polarized light sent out in substantially horizontal directions and adapted to be directed along roadways.

21. In illuminating apparatus, an essentially completely hemispheric-directional street lamp comprising a source of light and cooperating polarizing devices to produce beams of polarized light adapted to be directed along roadways.

22. A roadway illuminating apparatus, comprising a source of light and cooperating polarizing devices having angularly arranged multiple glass plates substantially forming surfaces of revolution to produce beams of polarized light sent out in substantially horizontal directions and adapted to be directed along roadways, and to direct the transversely polarized component of light adjacent said lamp.

23. A roadway illuminating apparatus, comprising a source of light and cooperating polarizing devices having angularly arranged multiple plates substantially forming surfaces of revolution to produce beams of polarized light sent out in substantially horizontal directions and adapted to be directed along roadways.

24. A roadway illuminating apparatus, comprising a source of light and cooperating polarizing devices substantially forming surfaces of revolution to produce beams of polarized light.

25. The method of illuminating roadways which comprises sending out essentially completely hemispheric-directionally as well as substantially horizontally along the road-

ways beams of vertically polarized light from a fixed source, and illuminating portions of the roadways by substantially horizontally forwardly directed beams of similarly polarized light from a normally moving source, and cutting out objectionable direct glare of such light from the line of vision of one viewing said roadways by polarized light viewing devices substantially cutting off such polarized light.

26. The method of illuminating roadways which comprises sending out along the roadways beams of polarized light from fixed sources, and illuminating portions of the roadways by forwardly directed beams of similarly polarized light from normally moving sources, and cutting out objectionable direct glare of such light from the line of vision of one viewing the roadways by polarized light viewing devices substantially cutting off such polarized light.

27. The method of illuminating automobile roadways and their intersections which comprises illuminating roadway intersections by downwardly directed light from adjacent elevated fixed sources, sending out substantially horizontally along the roadways beams of vertically polarized light from said fixed sources, illuminating portions of the roadways by substantially horizontally forwardly directed beams of vertically polarized light from normally moving sources and cutting out objectionable direct glare of such light from the line of vision of one viewing said roadways by polarized viewing devices substantially cutting off vertically polarized light.

28. The method of illuminating automobile roadways and their intersections which comprises illuminating roadway intersections by downwardly directed light from adjacent elevated fixed sources, sending out substantially horizontally along the roadways beams of polarized light from said fixed sources, illuminating portions of the roadways by substantially horizontally forwardly directed beams of polarized light from normally moving sources, and cutting out objectionable glare from such light from the line of vision of one viewing said roadways by polarized light viewing devices substantially cutting off such polarized light.

29. The method of illuminating automobile roadways and their intersections which comprises illuminating roadway intersections by downwardly directed light from adjacent fixed sources, sending out substantially horizontally along the roadways beams of polarized light from said fixed sources, and cutting out objectionable direct glare of such light from the line of vision of one viewing said roadways by polarized light viewing devices substantially cutting off such polarized light.

30. The method of illuminating roadways which comprises sending out essentially completely hemispheric-directionally as well as substantially horizontally along the roadways beams of polarized light from fixed sources, and cutting out objectionable direct glare of such light from the line of vision of one viewing said roadways by polarized light viewing devices substantially cutting off such polarized light.

31. The method of illuminating roadways or their intersections which comprises sending out essentially completely hemispheric-directionally as well as substantially horizontally along the roadways beams of polarized light from fixed sources and illuminating portions of the roadways by the forwardly directed beams of similarly polarized light from normally moving sources.

32. The method of illuminating the path of travel of vehicles or other moving objects which comprises projecting upon said path beams of polarized light from fixed sources, illuminating portions of said paths by the beams of similarly polarized light from normally moving sources, and viewing said beams of light through polarizing means.

33. The method of illuminating automobile roadways or their intersections which comprises sending out along the roadways beams of vertically polarized light from elevated fixed sources, and illuminating portions of the roadways adjacent said fixed sources of light by downwardly directed beams of differently polarized light simultaneously produced by said fixed sources.

34. The method of illuminating automobile roadways or their intersections which comprises sending out along the roadways beams of definitely polarized light from elevated fixed sources, and illuminating portions of the roadways adjacent said fixed sources of light by differently polarized light simultaneously produced by said fixed sources.

35. The process of illuminating roadways or their intersections, which comprises sending out essentially completely hemispheric-directionally as well as substantially longitudinally along the roadways beams of vertically polarized light from a source of light and illuminating portions of the roadways by downwardly directed light from said source.

36. The process of illuminating roadways, which comprises sending out essentially completely hemispheric-directionally as well as substantially longitudinally along the roadways beams of vertically polarized light from a source of light.

37. The headlight apparatus for automobiles or other vehicles comprising a pair of headlights each provided with plate glass reflecting polarizing devices to form a substantially vertically polarized reflected beam of light transmitted ahead of the vehicle and a downwardly inclined refracted beam of light illuminating the road surface under and

adjacent the automobile and polarized light viewing devices through which the driver of the vehicle can look and comprising adjustable light polarizing devices adapted to substantially cut off light polarized in a vertical plane to thereby eliminate the objectionable glare of the headlights of a similarly equipped approaching vehicle.

FRANK SHORT.

112 **Affidavit of Greenleaf Whittier Pickard.**

IN THE

UNITED STATES PATENT OFFICE

Before the Board of Appeals

In re application of
ALVIN M. MARKS
Serial No. 240,608
Filed November 16, 1938
113 For: Polarized Illumination

} Appeal No. 40,151

STATE OF NEW YORK,
COUNTY OF NEW YORK, } ss.:

GREENLEAF WHITTIER PICKARD, being duly sworn, deposes and says as follows:

I am a citizen of the United States of America and reside at Seabrook Beach, New Hampshire.

I received my academic education at Harvard University and Massachusetts Institute of Technology.

For the past forty (40) years I have specialized on the radiation phenomena, including light and the longer waves used in radio transmission.

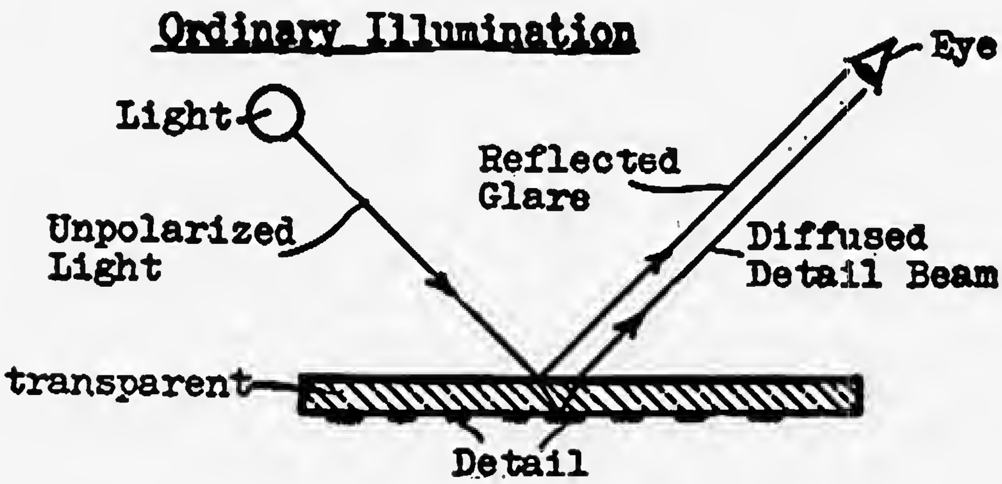
114 I am the author of numerous papers on radio transmission phenomena. I have had issued to me some one hundred-plus U. S. and foreign patents, among which is Patent No. 1,476,102 issued December 4, 1923, which shows a reflection polariscope, adapted for the rapid examination and comparison of thin mica films by transmitted polarized light.

I am past President and fellow, and recipient of the Medal of Honor, of the Institute of Radio Engineers, fellow of the American Association of the Advancement of Science, the American Academy of Arts and Sciences, Research Associate Blue Hill Observatory, a department of Harvard University, and fellow or member of a number of other technical and scientific societies.

I have studied polarization phenomena in the entire spectrum of known radiation including light and the longer waves used in radio transmission.

I have carried on experimentation dealing with the polarizing and analyzing of light with polarizing systems of the type described below, and the results of the experimentations are as follows:

(1) *Ordinary Illumination* 116



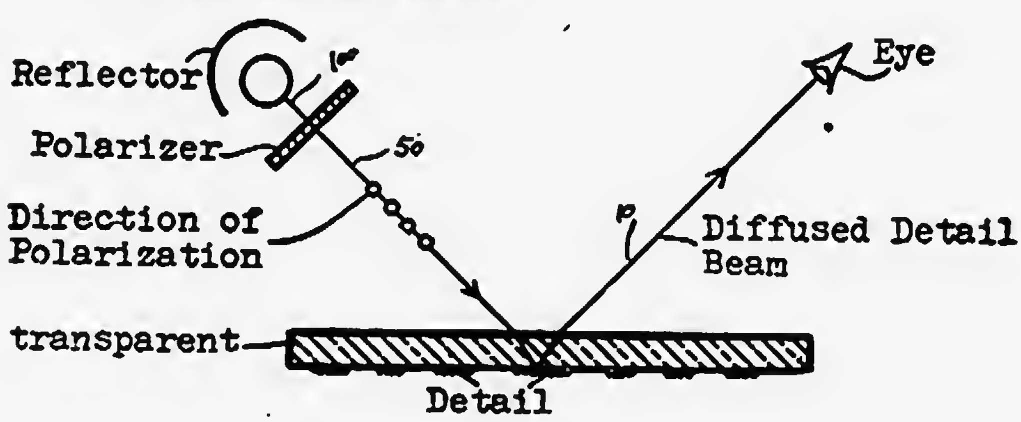
In Figure 1 I show the optics of ordinary illumination. A ray of ordinary unpolarized light from a light is directed
upon a viewing surface (which in the case of a glossy 117
printed page or picture comprises a thin transparent layer with certain detail therebeneath). The unpolarized light ray upon striking the reflecting surface is resolved into two ray components. One ray component of the light enters into the transparent layer and illuminates the detail therein. This light is diffused by the detail and the eye perceives this diffused detail beam. The second ray component of the light is reflected from the upper surface of

the transparent layer and this light ray is the reflected glare component. Since both the reflected glare component and the diffused detail beam each represent about 10% of the total amount of light, the reflected glare component seriously and blindly interferes with the eye perception of the diffused detail beam. This is the objectionable glare.

For clarity in the subsequent analysis, the plane of incidence of light upon the viewing surface may be explained as the plane defined by the light source, the point of impingement and the point of perception (the eye). In Figure 2, for example, the plane of incidence of the light upon the viewing surface coincides with the plane of the
119 paper.

(2) *Marks Glare-Free Illumination*

Present Invention



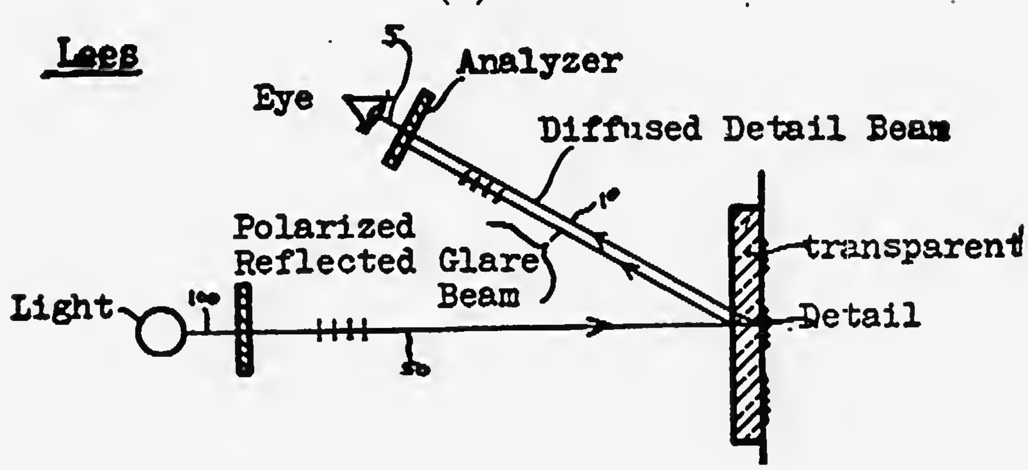
120 All of the light from a light source is directed by a reflector through a polarizer. The polarizer is so positioned that the direction of polarization of the light transmitted therethrough is normal (at a right angle) to the plane of incidence of the light upon the viewing surface. This polarization eliminates that portion of the light that constitutes the reflected glare component and leaves only that light which when impinged upon the viewing surface at an angle of about 33° to the surface enters completely into

the transparent layer and illuminates the detail. The eye perceives thus only the diffused detail beam and since there is no reflected glare, there is no interference with proper perception.

Marks employs a single polarizer and no analyzer. The viewing surface does not function as an analyzer because it does not reflect or absorb polarized light.

The two essential elements of Marks are (1) the elimination from the light beam, by polarization, of all light except that light polarized in a plane normal to the plane of incidence of the light, and (2) impingement of that so polarized light upon the viewing surface at an angle of
about 33° thereto, whereupon all of that light enters into 122
the transparent surface and is diffused by the detail. The objectionable glare component is thus completely eliminated.

(3) *Lees*



123

Light from a light source is directed through a polarizer and thus polarized in any desired plane (none specified). The so polarized light is impinged vertically on to the viewing surface. A substantial portion of this polarized light is reflected by the upper surface of the transparent layer and this polarized reflected glare beam is intercepted or blocked by an analyzer positioned in front of the eye. A second portion of the light travels into the transparent layer and illuminates the detail therein, the detail diffusing that light. The eye perceives this diffused detail beam which is now unpolarized and which therefore in part can travxel through the analyzer. This system is the so-called polarizer-analyzer method of eliminating glare.

(4) *Lowndes*

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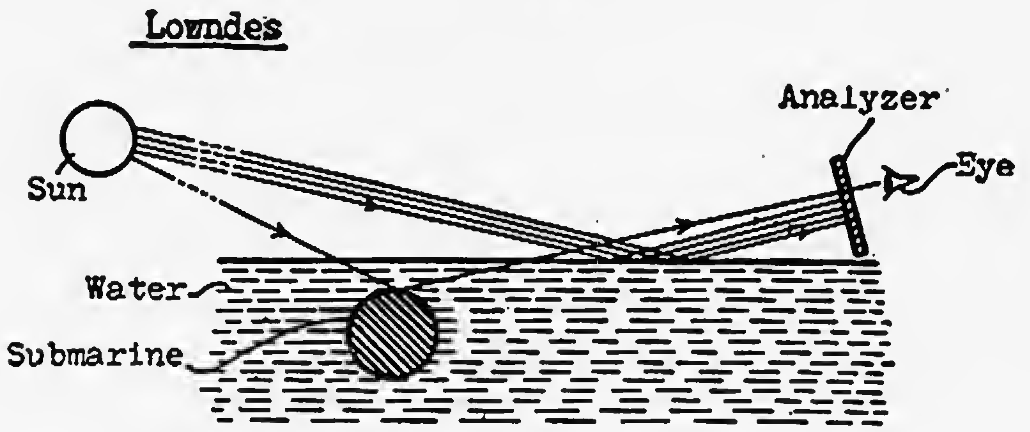
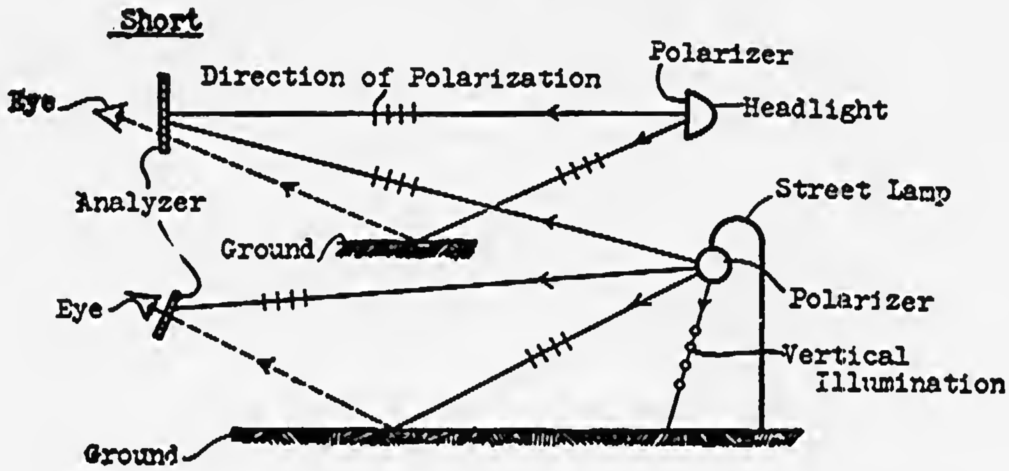


As in ordinary illumination (see (1) above), ordinary unpolarized light rays from the sun impinge upon the water. These light rays are resolved into two components. One component enters into the water and illuminates the submarine therein. The second component of the light rays is reflected from the upper surface of the water and this light is the reflected glare component. This reflected glare component is ordinarily so strong that the submarine beneath the water cannot be seen. Lowndes, therefore, places
126 an analyzer (tourmaline) in front of the eye. This analyzer absorbs (blocks) the reflected glare and the eye can perceive the submarine.

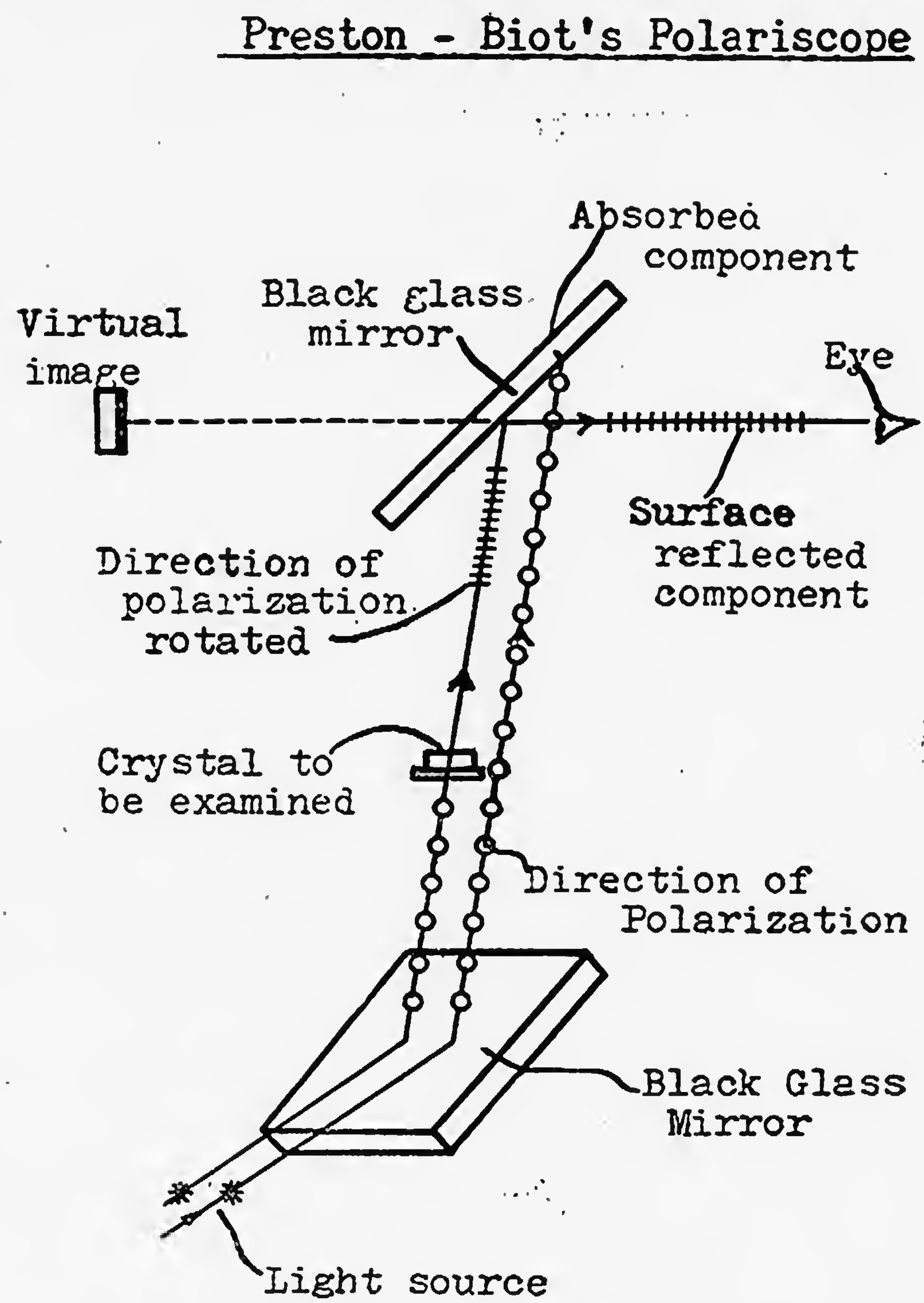
(5) *Short*



Short shows a system for the elimination of glare in automobile and road illumination. Light emitted from both headlights and street lamps is polarized vertically by a polarizer positioned over the headlight or street lamp, and this polarized light is directed toward both the eye of the driver of an approaching automobile and the eye of a pedestrian. This polarized light is absorbed or blocked out by means of an analyzer in front of the driver or pedestrian's eye. Light both vertically and horizontally polarized is also impinged upon the ground or roadway by the polarized rays and this light from the headlight and street lamp which strikes the ground is diffused (depolarized) by the ground or roadway. This unpolarized light then in part can travel through the analyzer and can be perceived by the eye. This is the so-called polarizer-analyzer system for eliminating glare.

128 129

(6) *Preston-Biot's Polariscope*



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Biot's Polariscope for more than 100 years has been the conventional means in the art of polarization of demonstrating the constitution of polarized light. It is also generally employed in examining crystals or detecting strains, as in glass. This polariscope is shown in every textbook dealing with polarization. The polariscope is diagrammatically shown above.

Two rays of unpolarized light from the light source are polarized by impingement upon polished black glass which acts as a mirror-polarizer. The mirror divides each ray of light into two components. One component travels into the black glass and is absorbed therein and the second component is polarized in the direction parallel to the plane of incidence of the light as shown by the circles on the ray. These two rays of light similarly polarized then travel upwardly. One ray travels unimpaired along its path to 134
the second black glass mirror and this polarized light passes into the black glass mirror and is completely absorbed thereby. This component is absorbed because of its direction of polarization with respect to the mirror.

The second polarized ray travels through the crystal to be examined and this crystal rotates the direction of polarization of the ray so that when this ray strikes the second black mirror it is totally reflected from the surface of the mirror and is seen by the eye as a virtual image of the crystal. This is the surface reflected component and this component is completely reflected from the surface of the mirror, unlike the first absorbed component, because its direction of polarization is now parallel to the plane of incidence of the ray upon the mirror.

The first black glass mirror acts as a polarizer and the 135
second black glass mirror acts as an analyzer. When the polariscope is used simply to demonstrate the constitution of polarized light the first black glass mirror can be rotated so that the observer, looking at the analyzer, either receives the completely reflected component or sees no light at all, depending upon the direction of polarization given the light by the first polarizer.

The Marks non-glare illumination has the following optical advantages over the systems outlined above and particularly over the polarizer-analyzer systems specifically as follows:

1. Light efficiency.

The Marks system has double the light efficiency of the polarizer-analyzer non-glare illumination systems shown above.

(2) *Present Invention* (3) *Lees*

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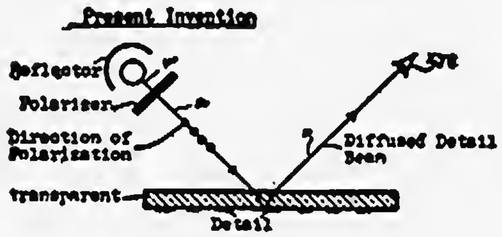

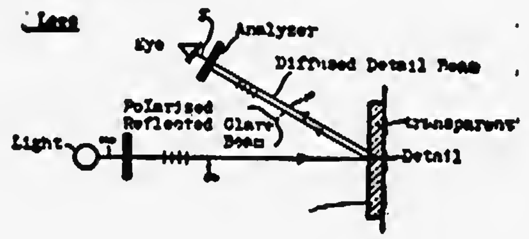

Thus, for example in Lees, which is typical of the polarizer-analyzer system, when the light is polarized by the first polarizer a maximum of 50% of the light is transmitted by the polarizer and 50% is absorbed or blocked out. (All percentages herein refer to the percent of the original 100% of light. It will be understood that the percentages recited may vary considerably according to the type of polarizers used, etc., but the precent relationships between Marks and polarizer-analyzer systems, such as Lees, are substantially accurate.) When this transmitted polarized
138 light impinges upon the surface of the painting, approximately 10% is reflected as the polarized reflected glare beam and 10% of the light is diffused and is reflected as the diffused detail beam. The remainder is lost by absorption. The glare beam is, of course, completely blocked by the analyzer before the eye. The diffused detail beam which has been depolarized in diffusing, and is therefore now unpolarized light, must travel through the analyzer

to reach the eye and the analyzer by polarization cuts out one-half of this light. Accordingly therefore in Lees the original 100% of light is cut to 50% by the first polarization and of this 50%, 10% of the light is diffused and reflected by the detail. When this 10% of light (diffused detail beam) passes through the analyzer in its path to the eye, one-half is blocked out reducing the total amount reaching the eye to 5%.

In the Marks system, the original 100% of light from the light source is reduced by polarization to 50%. This 50% travels completely into the transparent layer of the viewing surface and 10% is diffused and reflected by the detail therein. All of this 10% of the light passes to the eye. 140

Thus the amount of useful light (10%) from an equal light in the Marks system is two times greater than the amount of useful light (5%) in the Lees polarizer-analyzer system. Conversely an original light source one-half the candle power could be used by Marks to obtain the same illumination as Lees.

2. Metal illumination.

In a polarizer-analyzer system such as Lees, metal that is viewed will have a completely black appearance that is, of course, quite unnatural. This is because of the fact that polarized light is completely reflected without diffusion by the metal surface. In other words a metal surface acts as a complete and true reflector for a polarized ray. This is 141
an optical fact. When this reflected polarized light is absorbed or blocked out by the analyzer positioned before the eye, all of the light reflected from the metallic surface is completely blocked out and hence the surface appears to be entirely black. Thus, if a polarizer-analyzer system such as that of Lees were used to illuminate a dinner table, all the silverware and metal pitchers, etc., would appear completely black.

In the Marks system, on the contrary, the polarized light that impinges upon the metallic surface is completely reflected to the eye since it cannot travel into the surface as in the case of a transparent layer. This causes the eye to perceive the metal in substantially its normal shiny appearance to which the eye is accustomed.

3. Analyzer adjustment and distortion.

In the polarizer-analyzer system, the analyzer before the eye must be adjusted, as Lees states, to a particular position, in accordance with the direction of polarization of the light. An analyzer is composed of refractive material such
143 as glass and therefore it refracts the light. Unless the analyzer is very carefully ground and polished as can be done only by expensive processes, there is optical distortion quite annoying to the eye.

The use of an analyzer in front of the eye also distinctly limits the field of vision.

In the Marks system there is no element at all between the eye and the object to be viewed and hence none of these difficulties of adjustment, distortion or restricted field of vision is encountered.

(S) Greenleaf Whittier Pickard.

Sworn to and subscribed before me
this 24 day of October, 1941.

144

(S) Ann Starr,
Notary Public.

(Seal)

145

Examiner's Statement dated August 20, 1941, in Application Serial No. 240,608.

Paper No. 11

DEPARTMENT OF COMMERCE,
U. S. Patent Office
Washington, D. C.

In re application of
Alvin M. Marks
Serial No. 240,608
Filed Nov. 16, 1938 146
For: Polarized Illumination

On Appeal Before The Board of Appeals

EXAMINER'S STATEMENT

This is an appeal from the action of the Primary Examiner in finally rejecting all the claims (claims 1-4, 16, 20, 34-47) in the case. Subsequent to the entry of the final rejection applicant cancelled all the claims excepting 1-4, 16, 34, 37, 43 and 44 and substituted claims 53-68 for the purpose of appeal. Of the substituted claims 53 to 64 inclusive and 66, 67 appear to be allowable.

The claims on appeal are accordingly 1-4, 16, 34, 43, 44, 65 and 68, which read as follows:

1. The method of viewing a light refractive object 147
having areas of different reflectivity by omitting the glare effect which comprises transmitting a beam of light to the light refractive object along an axis of substantially between 20 and 70 degrees to the normal to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam upon said light re-

fractive object, thus substantially eliminating the reflective glare component of the beam; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and diffusedly reflecting the light emanating from said light refractive object to the objective with no polarizing medium between the object and the point of observation.

3. The herein described method of providing glare-free illumination of a light refractive object having areas of different reflectivity which comprises trans-
149 mitting a beam of light to the light refractive object along an axis of substantially between 20 and 70 degrees to the normal to the surface of the light refractive object; plane-polarizing the rays of said beam in planes substantially normal to the planes of incidence of the respective rays prior to the impinging of the beam upon said light refractive object, thus substantially eliminating the reflective glare component of the beam; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and diffusedly reflecting the light emanating from said light refractive object to the objective with no polarizing medium between the
150 object and the point of observation.

4. The herein described method of providing glare-free illumination of a light refractive object having areas of different reflectivity which comprises transmitting a beam of light to the light refractive object along an axis of substantially betwen 20 and 70 degrees to the normal to the surface of the light refractive object; plane-polarizing the light in planes substantially normal to the planes of incidence of the re-

spective rays before it is impinged on the light refractive object to eliminate that component of the light which is substantially the only component of the light which would be reflected by the surface if impinged thereon; impinging the remaining part of the beam onto the light refractive surface, thus causing substantially the entire remaining part of the beam to pass into the light refractive object; and transmitting the light emanating from said light refractive object to the point of observation.

16. A lighting device adapted to provide glare-free illumination for a viewing surface comprising a light
source, a polarizing means positioned to plane polarize 152
the rays of light from said light source in planes substantially normal to the planes of incidence of said rays of light with respect to said viewing surface and means for directing said plane polarizing light onto said surface within the angular range of 20° to 70° to the normal of said surface.

34. An apparatus for providing glare free illumination simultaneously for substantially vertical surfaces and for substantially horizontal surfaces comprising a light means, a first polarizer and a second polarizer adapted to polarize light from said light source, said light source and said polarizer being mounted in fixed relation to a wall, said wall being capable of reflecting
polarized light without depolarization, light passing 153
from said light source through said first polarizer being so directed upon said wall that after reflection said light is directed upon horizontal surfaces at an angle of approximately 33° thereto, the first polarizer being so oriented that light passing therethrough is polarized in a plane normal to its plane of incidence upon the horizontal surfaces, light from said light source being simultaneously directed through said second

polarizer and being incident upon said wall at such an angle so as to travel in a substantially horizontal direction after such reflection, said second polarizer being so oriented as to vertically polarize said horizontally reflected rays, thus providing a large area low intensity field of polarized glare free light.

43. A lighting device for providing glare-free illumination of a viewing surface comprising a frustro-conical sheet polarizer positioned with its axis normal to the viewing surface, the polarizing axes of said frustro-conical sheet polarizer paralleling the circumference of concentric circles having a center in the
155 common vertical axis of the center in the common vertical axis of the frustro-cone, a light source positioned to emit light rays through said frustro-conical sheet polarizer in a multiplicity of directions away from said axis at an angle of from 20° to 70° to said viewing surfaces, said light rays being thereby plane polarized in planes normal to their planes of incidence upon the viewing surface.

44. In an apparatus for simultaneously providing glare-free illumination for substantially horizontal and substantially vertical viewing surfaces, a light source supplying light through a large solid angle, a first polarizing means and a second polarizing means, said first polarizing means being positioned to ver-
156 tically plane polarize light emitted in substantially horizontal directions, said second polarizing means being positioned to plane polarize light emitted at an angle of between 20° and 70° to the horizontal in planes normal to their planes of incidence of said light upon said horizontal viewing surface.

65. A lighting device adapted to provide glare-free illumination for a viewing surface comprising a light

source, polarizing means, a reflector adapted to reflect light from said light source onto said polarizing means, said polarizing means being positioned to plane polarize the reflected light from said lighting device in planes substantially normal to the planes of incidence of said light upon the viewing surface, said reflecting means further directing said light through said polarizing means onto said viewing surface at an angle of about 33° to the surface.

68. In a device for illuminating a body surface portion having an exterior light refractive layer, a light source located at a distance from said body surface
portion; means for directing light rays from said light 158
source onto said body surface portion at an angle in the range from 20° to 70° to said body surface portion; and a light polarizing layer extending across the path of said light rays so that substantially all usable light rays reaching said body surface portion from said light source pass through said polarizing layer, said polarizing layer being so shaped and so axially positioned relatively to the direction of the light rays that substantially all light transmitted through said polarizing layer toward said body surface portion is plane polarized in planes normal to the planes of incidence of said light rays upon said body surface and thereby substantially eliminating the reflection from the upper-
most surface of said refractive layer of light rays 159
transmitted to said body surface portion from said light source.

The claims are considered unpatentable over the well known polarizer-analyzer arrangement and also over the disclosures in:

Preston, "Text on the Theory of Light", 1895, second edition, MacMillan & Co., N. Y., pages 291 and 292;

Lees, article in "Discovery", Aug. 1921, publ. J. Murray, London, pages 195-197;

(Br.) Lowndes	177,948	April 13, 1922;
Short	1,733,915	Oct. 29, 1929.

Certain of the claims are further considered unpatentable because of indefiniteness.

Claims 1-4 were during the prosecution of the case rejected on the ground of res adjudicata in view of the fact that the final rejection in applicant's copending case 755,557, filed Dec. 1, 1934, was upheld by the Board of Appeals in their decision of Oct. 26, 1938. While claims 1-4 cover the
161 same subject matter as the claims considered by the Board of Appeals in case 755,557, the wording of the instant claims are not identical and therefore the rejection on the ground of res adjudicata has been withdrawn.

Briefly stated, the appealed claims cover essentially (1) a *method* for illuminating a viewing surface with polarized light so as to avoid or minimize glare reflections and (2) a polarizing *device* arranged with respect to a viewing surface for producing the result under (1).

Plane polarized light differs from "ordinary" unpolarized light in that the light vibrations (displacements) in plane polarized light occur in parallel planes as the light is propagated through space, whereas the vibrations for unpolarized light take place in all possible directions, that is,
162 up and down, sideways, etc.

Applicant has disclosed a number of different polarizing devices.

In Figure 20, P illustrates a sheet polarizer having a dichroic crystalline surface (or having crystalline particles) which crystalline surface or particles resolves an incident beam into two components polarized at right angles to each other, one of the beams is, however, substantially completely *absorbed* and the other transmitted as usable plane polarized light.

Figure 1 shows another form in which polarizer 12 com-
prises a plurality of thin transparent (non-metallic) plates
either separated from each other by a thin air space (figures
2, 5) or by a thin sheet having different index of refrac-
tion from that of the plates (figure 6). As is well known,
light striking each of the plates is divided into two com-
ponents, one reflected and the other transmitted (re-
fracted). The two components are, however, plane polar-
ized at right angles to each other. The vibrations in the
reflected beam are in general parallel to the reflecting sur-
face and perpendicular to the plane of incidence of the
impinging beam, and the vibrations in the transmitted
beam (which is the usable beam in applicant's set-up) are 164
parallel to the plane of incidence and perpendicular to the
vibrations in the reflected beam. The two plane polarized
beams such as the reflected and refracted beams have the
same polarizing properties, and they differ only in that the
vibrations in one beam are at right angles to that of the
other.

It appears that applicant's method claims 1-4 merely set
forth a well known arrangement of polarizer and analyzer.
Usually light polarizing devices comprise two "polarizers",
one of which may be fixed and the other, called the analyzer,
rotatably mounted. When the plane of polarization, or in
other words the planes of vibration, of the analyzer is at
right angles with respect to the polarizer, a minimum of
light passes through the system.

The condition imposed by claims 1-4 is in substance, that 165
the polarizing plane of the light source be at right angles to
polarizing plane of the viewing surface, which latter sur-
face acts in the manner of an analyzer.

The claims appear to merely recite the inherent and
natural laws of polarization due to reflection from a non-
metallic surface.

A glass-top desk or a printed page, etc., each inherently
acts as a polarizer to plane polarize a beam incident there-

166 on at the proper angle. Similarly each such surface acts as an analyzer to eliminate light having vibrations in a particular plane. In the case of a printed page illuminated with light incident thereon at the polarizing angle there is a partial resolution of the light vibrations into two components, respectively in and at right angles to the plane of incidence. The light vibrations parallel to the surface and at right angles to the plane of incidence are the most freely reflected from the surface of the page while others strike down into the surface and are diffused (unpolarized), or transmitted, which latter light vibrations form the useful illuminating beam. The reflected light beam having
167 the vibrations parallel to the surface of the printed page is a more or less specularly reflected beam which may cause undesirable "glare" especially if the amount of light so reflected is large in proportion to the diffused light from the print itself. If it be desired to inspect the table top as at 12″ (figures 18 and 19), it is apparent that beam 13″ would constitute the useful beam of light while the reflected beam 9″ from the top of the glass surface would constitute the undesirable glare beam. Applicant's placing and properly orienting the polarizer between the light source and the object viewed to eliminate a particular polarized component appears to be substantially identical with the usual assembly of polarizer-analyzer elements. The method is the same no matter what surface is viewed. As indicated above, a white page having print thereon has a more or
168 less "shiny" surface which produces glare reflections when viewed at a particular angle with respect to the light source. Applicant uses no new object to be viewed, and his object has the inherent property of readily reflecting vibrations in a particular plane and suppressing the vibrations in planes at right angles thereto. No invention is believed to be involved in plane polarizing the incident light and directing it so that the object viewed receives no light vibrating in

the plane which is readily reflected and thereby eliminating the light ordinarily reflected to the observer from the "shiny" area of the object viewed.

Claims 16, 34, 37, 43, 44, 65 and 68 which cover the combination of a polarizer (broadly defined) and a viewing surface, the arrangement again being such that the plane of polarization of the polarizer is at right angles to the plane of polarization of the analyzer (viewing surface) appear to relate to the usual polarizer-analyzer set-up.

While claims 34 and 44 call for a plurality of polarizers, such as shown in figures 15, 16, it does not appear that the arrangement involves more than a mere duplication of a
single polarizer-analyzer set-up. 170

Claims 37, 43 and 65 calling for some form of reflector and claim 68 reciting a "polarizing layer * * * so shaped and so axially positioned relatively to the direction of the light rays * * *" appear to merely define well known polarizing units, each arranged in a well known manner.

Further, claims 1-4, 16, 34, 37, 43, 44, 65 and 68 appear to be met in substance in each of the references Preston—pages 291 and 292, Lowndes or Lees ("Discovery", pages 195-197).

In figure 148 of Preston is shown two reflecting glass "mirrors", one acting as a polarizer and the other as an analyzer. With the possible exception of the recitation "* * * having areas of different reflectivity" in the first
part of each of claims 1-4, it appears that they read sub- 171
stantially directly word for word on Preston, pages 291, 292 and figure 148.

When applicant passes the light through polarizer P (figure 20) or through P (figure 21), he eliminates all the light vibrations save those vibrating in a particular plane. This appears to be exactly what happens when light strikes the upper mirror in Preston's figure 148. The reflected light in Preston which impinges on the lower mirror is plane polarized in a particular plane, and the said lower

mirror whose polarization plane is at right angles to that of the top mirror acts as an analyzer to stop substantially all the reflected light (which corresponds to the glare light in applicant's device). If there are any spots or any areas on Preston's lower mirror corresponding to applicant's printed page which would diffuse and depolarize the light from the top mirror, then such spots or areas would reflect the light toward an observer looking at Preston's lower mirror along the line of sight indicated. The fact that applicant may have a different "viewing" surface such as a book, for example, in figure 1, does not appear to make his method patentable over Preston's "method". The phe-
173 nomena described in claims 1-4 and described by Preston, pages 291 and 292, hold no matter what polarizing medium or what reflecting "viewing" medium is used. In Lees' disclosure, "Discovery", pages 195, 196 and 197, a polarizing light source as well as an analyzing prism is utilized. However, Lees' picture or painting when illuminated by polarized light acts in a manner similar to that set forth by applicant (see pages 195 and 196 in Lees'). While Lees uses an analyzer, it appears that the omission of the analyzer and the moving of the painting into the position of minimum glare would not involve invention. Lowndes places polarizing (analyzing) tourmaline plates in front of the observer's eyes in order to eliminate the glare reflection. The placing of the polarizing plates between the light source and the object instead of between the latter
174 and the observer is not believed to be a patentable distinction.

The "Product" claims 16, 34, 37, 43, 44, 65 and 68 likewise appear to be met by each of Preston—pages 291 and 292, Lees—pages 195-197, or Lowndes. While the specific reflector (claims 37, 43 and 65) is not shown in the prior art cited, it appears that the use of a reflector wherever desired is not patentable.

Claims 37, 43 and 65 are each further deemed to be unpatentable over either Preston, pages 291 and 292, or Lees, pages 195-197, in view of Short. To utilize the Short polarizer (figures 1, 7-9 or 11) in either Preston or Lees is not believed to be patentable.

Claims 34, 44 and 68 are each further believed to be unpatentable over Short in view of Lees, pages 195-197. As indicated above, the using of Short's polarizing means to illuminate Lees' paintings is not believed to be patentable. In connection with the plural polarizers in claims 34, 44, it should be noted that Short discloses a plurality of polarizing elements in his light source enabling the proper illumi-
nation, by polarized light, of the roadway in several di- 176
rections.

Claims 1-4 each further appear to be unpatentable because of indefiniteness. Each of said claims recites in part "impinging the remaining part of the beam * * *." It is not clear, however, what the "remaining part of the beam * * *" is, nor is it clear that there is any such remaining part of a beam. All of the light impinging upon the (refractive) object to be viewed is, it appears, plane polarized, and it is not seen wherein applicant obtains "a remaining part" to be "impinged" onto the surface.

Claims 34, 37 and 44 are each further believed to be indefinite and therefore unpatentable. The plural polarizers in claims 34, 44 appear to be in the nature of an aggregation of unrelated elements, and in claim 37 the "depolar-
izing surface", last line, has no function as set forth in the 177
claim. The depolarizing surface has utility when coacting with the other elements of the device (see, for example, allowed claim 63), but in the set up defined in claim 37, it does not appear that the depolarizing surface has any particular function.

While, as indicated above, the method claims 1-4 have different terminology when the appealed claims in 755,557 it appears that said claims 1-4 as well as the "product" claims 16, 34, 37, 43, 44, 65 and 68 are unpatentable for substantially the same reason as set forth by the Board of Appeals, Oct. 26, 1938, with respect to the claims in the adjudicated case 755,557.

In view of the above discussion, it is respectfully submitted that the final rejection should be upheld.

Respectfully,

Examiner, Div. 7.

Attorneys:

179 OSTROLENK & GREENE,
10 East 40th St.,
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Opinion of Board of Appeals in Application Serial No. 755,557.

Appeal No. 23,634
Hearing: October 5, 1938

IN THE

UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

Ex parte ALVIN M. MARKS 182

Application for Patent filed December 1, 1934, Serial No. 755,557. Non Glare Surface Illumination.

MESSRS. OSTROLENK, GREENE & MARSEN for applicant.

Appellant submits claims 52 to 55, inclusive, for our consideration although the examiner stated in his supplemental statement of October 11, 1938 that these claims have not been entered. For this reason we must decline to consider
them. The claims before us are claims 46 to 51, inclusive, 183
discussed by the examiner in his statement of November 18, 1937. We note that appellant in his amendment adding claims 52 to 55, inclusive, suggested that claims 46, 48 and 50 be withdrawn. We are, however, considering all the claims on appeal.

Claim 46 is illustrative.

> 46. The method of illuminating an object comprising the polarization of light emanating from a source and impinging upon said object, the light being polarized in a plane substantially at right angles to the plane normal to the surface of said object whereby glare is eliminated from light reflected by said object.

The references relied upon are as follows:

Lowndes (British)	177,948	April 13, 1922
French Patent	692,916	Aug. 11, 1930

185 Publication: "Old Paintings and Polarized Light" by Lees in "Discovery", August, 1931—pages 195-197—Published by J. Murray, 50 Albemarle St., London, England.

We note that each of the claims calls for a method of illuminating an object and are concerned primarily to directing polarized light upon an object and viewing it by the reflected rays.

The examiner has rejected these claims as improper process claims on the ground that it is immaterial, so far as the method of illuminating an object is concerned, whether polarized light or sunlight is directed on an object. We are in agreement with this view. If the method were set forth as one for viewing an object by omitting the glare
186 effect, this question might not arise, provided the claims included such step as omitting the glare. Furthermore, claims 46 to 51 are not clear and definite for reasons stated by the examiner. Moreover, the claims would apparently read on a set up in which a light polarizer is placed directly above the table upon the object to be observed if placed parallel with the table so that the polarizing beam strikes the table in a substantially perpendicular direction. Evidently, such a set up would present a glare illumination or

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at least there is nothing in the specification to indicate to the contrary. With such interpretation of the claims, they are obviously unpatentable over the prior art references discussed by the examiner wherein polarized light is directed on an object to be viewed by an observer. This is true regardless of whether the observer wears glasses with polarized lenses or not.

The decision of the examiner is affirmed.

EUGENE LANDERS
Examiner-in-Chief

F. P. EDINBURG
Examiner-in-Chief 188

J. W. CLIFT
Examiner-in-Chief
Board of Appeals

October 26, 1938

MESSRS. OSTROLENK, GREENE & MARSEN
10 E. 40th St.,
New York, N. Y.

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Paper No. 20

Opinion of Board of Appeals in Application Serial No. 240,608.

Appeal No. 40,151
Hearing: November 19, 1941

IN THE

UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

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Ex parte ALVIN M. MARKS

Application for Patent filed November 16, 1939, Serial No. 240,608. Polarized Illumination.

MESSRS. PINELES & GREENE for appellant.

This is an appeal from the action of the Primary Examiner finally rejecting claims 1, 2, 3, 4, 16, 34, 37, 43, 44, 65 and 68.

192 Claim 68 is illustrative and reads as follows:

> 68. In a device for illuminating a body surface portion having an exterior light refractive layer, a light source located at a distance from said body surface portion; means for directing light rays from said light source onto said body surface portion at an angle in the range from 20° to 70° to said body surface por-

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tion; and a light polarizing layer extending across the path of said light rays so that substantially all usable light rays reaching said body surface portion from said light source pass through said polarizing layer, said polarizing layer being so shaped and so axially positioned relatively to the direction of the light rays that substantially all light transmitted through said polarizing layer toward said body surface portion is plane polarized in planes normal to the planes of incidence of said light rays upon said body surface and thereby substantially eliminating the reflection from the uppermost surface of said refractive layer of light rays
transmitted to said body surface portion from said 194
light source.

The references relied upon are:

Lowndes (British),	177,948,	Apr. 13, 1922,
Short,	1,733,915,	Oct. 29, 1929,

Preston, "Text on the Theory of Light", 1895, Second Edition, MacMillan & Co., N. Y., pages 291 and 292,

Lees, Article in "Discovery", Aug. 1921, Publ. J. Murray, London, pages 195 to 197.

Appellant has withdrawn the appeal as to claims 2, 4 and 37.

The invention relates to a method and apparatus for il-
luminating a light refractive object having areas of dif- 195
ferent reflectivity and without producing any glare. The object may be a glass plate place on a grained wood surface as shown in appellant's Figs. 18 and 19. However, the invention is not confined to illuminating only this type of object as it may also be used to eliminate glare from light falling on a printed page such as the pages of a book.

Appellant's method consists broadly in plane polarizing the light beam coming from the light source and directing it on the surface viewed at an angle ranging from 20° to 70°, preferably 33°. The rays of the beam are plane polarized in a plane substantially normal to the plane of incidence of the beam on the surface. Appellant states that this method eliminates most of the glare.

Appellant has illustrated on page 6 of his brief how the unpolarized light produces glare by being reflected at the surface. On page 7 of his brief he illustrates how the light beam is polarized before striking the surface and the component which produces the glare has been eliminated. He
197 states that this result is obtained due to directing the beam at a critical angle of 33° to the viewed surface and to polarizing of the light from the source in a plane normal to the plane of incidence before it strikes the surface. According to the illustration on page 5 of the brief, the vibrations of the light ray in the plane of incidence are eliminated by the polarizer. All the other vibrations will be transmitted, those in a plane normal to the plane of incidence being completely transmitted. Apparently from appellant's disclosure it is mainly the vibrations in the plane of incidence which are reflected at the surface and if these vibrations are eliminated most of the glare will be eliminated.

It is not entirely clear from appellant's disclosure why the ray is directed at an angle of incidence of 33°. Appel-
198 lant does not explain why this angle is critical in his brief. There is some reference made on pages 2 to 4 of the specification that the angle may refer to the angle of incidence of a beam at which it is completely polarized in one plane by reflection from the surface.

The examiner apparently construes appellant's disclosure as being the usual set up of a polarizer and an analyzer. Perhaps he refers to the polarizer as being appellant's part P (Fig. 19) and the reflecting surface at 8″ as the analyzer. If appellant depends on the polarization at the surface by reflection for his result the examiner's position appears to be warranted. Appellant, however, urges that he does not have the usual polarizer and analyzer set up. He urges that he has only a polarizer arranged in a specific way and that the beam is directed toward the viewed surface at a certain angle range and he thereby achieves his result. He, however, does not clearly state why his angle of incidence is critical or helps to produce the result.

In the prior art cited by the examiner it has been recognized that glare can be overcome by using an analyzer at the eye. An analyzer is, of course, the same as a polarizer
in its action. Lowndes shows the beam from the sun strik- 200
ing the water surface where it is plane polarized and then passed through an analyzer where the beam is again polarized and is entirely screened out when the analyzer is placed in the correct position. Appellant has arranged his polarizer across the beam before it strikes the surface and he thereby urges that he achieves his result. If it is necessary to provide a polarizer to polarize the beam in a plane normal to the plane of incidence and to also employ the polarization due to the reflection, it seems to us that appellant has not made any unobvious change by arranging the polarizer between the source of light and the reflecting surface. In a table lamp this would be a convenient way to arrange the parts rather than using an eye piece to polarize the rays. It is our view that the claims are
not patentable over Lowndes. 201

The Lees disclosure also shows the use of an analyzer for screening out the light which produces the glare. It also shows that a polarizer must be used between the light source and the reflecting surface. This is apparently necessary because the beam is not directed towards the surface at an angle at which the ray will be polarized by reflection. The disclosure shows the beam directed perpendicularly toward the surface. However, if the angle be changed to 33° and the polarizer properly rotated to screen out the vibration in the plane of incidence, no analyzer would be necessary. Perhaps this is due partly to the fact that the incident beam will be polarized at the reflecting surface. It is our view that to make this change in Lees involves no invention. Any one expert in optics and illumination would gain sufficient knowledge from the Lowndes disclosure to make this change.

The Preston disclosure is stressed by the examiner as being very pertinent. It is clear that light ray is polarized in a plane by the lower mirror illustrated on page 17 of
203 appellant's brief. This polarized ray is absorbed by the upper mirror when it is arranged at the proper angle with respect to the lower mirror. Therefore the ray that is incident on the upper mirror surface has been screened so it contains no vibrations in one plane. If the plane of polarization is properly chosen, the ray impinging on the upper mirror and which would normally produce glare will not be reflected to produce any glare. We think that this reference is pertinent and that the claims are not patentable over this disclosure.

The examiner has applied the references in detail to the groups of claims and we think properly so. For the specific reasons he has assigned it is our view that the claims are not patentable. We have also set forth above our understanding of the references and how they apply to ap-
204 pellant's claims.

It is noted that claim 44 includes two polarizing means but this is no more than a duplication of polarizers in the references.

Most of the claims are very broadly drawn. The recitation of the incident angle of the ray ranging between 20° and 70° is so broad that it appears that this limitation is of no material or critical importance.

The appeal as to claims 2, 4 and 37 is dismissed.
The decision of the examiner is affirmed.

EUGENE LANDERS
Examiner-in-Chief

F. P. EDINBURG
Examiner-in-Chief

J. W. CLIFT
Examiner-in-Chief

Board of Appeals

December 17, 1941. 206

MESSRS. PINELES & GREENE
10 East 40th Street
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Supplemental Examiner's Statement dated August 10, 1941, in Application Serial No. 240,608.

DEPARTMENT OF COMMERCE
U. S. PATENT OFFICE
Washington, D. C.

In re application of ALVIN M. MARKS Serial No. 240,608 Filed Nov. 16, 1938 For: POLARIZED ILLUMINATION	On Appeal Before The Board of Appeals

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SUPPLEMENTAL EXAMINER'S STATEMENT

Remanded by Board of Appeals to primary examiner for consideration of the communication and affidavit filed after appeal had been taken.

Applicant proposes to cancel claims 2, 4 and 37, withdrawing the appeal as to these claims.

The affidavit of Mr. Pickard, a qualified expert on polarization, has been considered.

The affiant sets forth a full explanation of the optical principles bearing on the issue in the case and he contrasts the mode of operation attributed to the references with the disclosure of the present case.

210 The affidavit has been examined and nothing is found therein which should lead to any conclusion as to the claims on appeal different from that originally reached.

With reference to the affiants' discussion, pages 8, 9 on "Light Efficiency", not previously emphasized in the case, it appears that Biot's polariscope described on pages 291, 292 of Preston's Text of record and also on page 7 of Mr. Pickard's affidavit, would yield substantially the same efficiency as applicant's set-up.

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The disclosure on page 291, lines 15-21 of Preston's Text of record would also, it appears, produce substantially the same results as applicant's particular arrangement, since the tourmaline polarizer and the glass plate in the Text are adapted to be arranged in identical relation to that shown in affiants' illustration on page 3 and in Fig. 20 of the application.

Since the claims in question do not deal with the illumination of metal surfaces, affiants' discussion on page 10 under *"Metal Illumination"* is not pertinent to the issue. In this connection attention is directed to page 66, lines 15-18, where it is stated that the polarizing principle involved is not applicable to metals. In any event the nature 212
of the substance viewed appears to be patentably immaterial insofar as the method (or illuminating apparatus) is concerned.

As above stated, nothing is found in the affidavit to alter the original conclusions as to the patentability of the appealed claims.

Respectfully,

Examiner, Div. 7.

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BRIEF FOR APPELLEE

United States Court of Appeals

DISTRICT OF COLUMBIA

APPEAL NO. 8716

ALVIN M. MARKS, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

APPEALS FROM THE JUDGMENT OF THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

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E. L. REYNOLDS,
Of Counsel.

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United States Court of Appeals

DISTRICT OF COLUMBIA

APPEAL No. 8716

ALVIN M. MARKS, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

APPEAL FROM THE JUDGMENT OF THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

INTRODUCTION

This is an appeal from the judgment of the District Court of the United States for the District of Columbia (3)[1] dismissing the complaint in an action under R. S. 4915 (U. S. C., title 35, sec. 63) in which it was sought to have the Court authorize the issuance of a patent containing claims 1, 3, 65, and 68 of application No. 240,608, filed by the appellant for patent on an alleged improvement in polarized illumination.

APPELLANT'S APPLICATION

The application here involved (7) discloses an illuminating system in which a polarizer is placed between

[1] The numbers in parentheses refer to pages of appellant's appendix.

the source of light and the object to be viewed and the light is so directed as to strike the object at an angle between twenty and seventy degrees. It is alleged that by this arrangement the light component which is normally reflected from the surface, thus causing glare, is eliminated.

THE SHORT PATENT

The patent to Short No. 1,733,915 (36) discloses an illuminating apparatus and process whose object is the elimination of glare by means of polarization. In Figure 9 of this patent, there is disclosed a street lamp, some of whose rays are directed toward the ground at an angle of approximately 60° with the horizontal. Between this lamp and the ground there is placed a polarizer which is generally similar to that employed by the plaintiff and which polarizes the light in substantially the same manner.

THE LOWNDES PATENT

The British patent to Lowndes No. 177,948 (35) discloses the prevention of glare in reflected light by placing a polarizing device between the reflecting surface and the eye of the observer.

THE PRESTON PATENT

Preston, "Text on the Theory of Light," 1895, Second Edition, MacMillan & Co., New York, N. Y. (32), discloses on pages 291 and 292 the fact that light reflected from any given surface has a definite polarization and that such light may be eliminated by a polarizer placed between the reflecting surface and the eye. Preston also discloses that if a polarizer be placed between the source of light and the reflecting surface and properly adjusted, the reflected light may be eliminated.

THE LEES ARTICLE

The article by Lees (26) in "Discovery" August 1921, published by J. Murray, London, discloses on pages 195 to 197 a method of viewing old pictures in which polarized light is directed onto the picture and a polarizer is placed adjacent the eye of the observer, whereby certain components of reflected light may be eliminated.

SUMMARY OF ARGUMENT

1. The principles on which appellant's alleged invention is based are all well known in the art.

2. The appealed claims call for nothing more than an obvious modification of the prior arrangement of Lowndes, Preston, or Lee, for eliminating glare by viewing an object through a polarizer which cuts out the reflected component of light.

3. The exact angle at which the light strikes the object to be viewed is a matter of choice, involving no invention.

4. The appealed claims are anticipated by the patent to Short.

ARGUMENT

The appellant's process is based on the fact that the portion of a ray of unpolarized light which is reflected from the surface of an object being viewed, and thus causes glare, has a particular kind of polarization. He avoids the glare by passing the light through a polarizer which eliminates this glare-form-

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ing component and passes only light of such a polarization that it will not be reflected from the surface.

The two principles involved in this process are both old and well understood. Devices which will pass only those portions of an unpolarized ray of light which have a desired polarization are well known in the art. Such devices are disclosed in each of the four references cited above. It is also common knowledge that reflected light is, to a large extent, definitely polarized. Thus Lowndes (35) states that "reflected light differs from the transmitted light in that it is very largely polarized"; Preston (32) states "that—light when reflected from the surface of glass acquires properties similar to those possessed by the light transmitted through a plate of tourmaline—that in fact light may be polarized by reflection—the same occurs when light is reflected from water and other transparent substances" and Lees (29) refers to "the light reflected from the surface being for the most part polarized."

It should be borne in mind that polarization is not an actual conversion of one kind of light to another, but merely a straining out of certain components. No new kind of light is created. Accordingly, when it is said that reflection polarizes light what is meant is simply that it is only that portion of the light having a particular polarization which is reflected.

From the two facts just stated, namely, that reflected (glare) light has a definite polarization and that devices are available which will prevent the passage of that part of a light ray having any particular polarization which it is desired to eliminate, it is obvious that glare may be eliminated by the use of a conventional polarizer, so adjusted as to cut out the reflected component. Each of the references relied on here recognizes and utilizes this principle for eliminating reflected light. Lowndes, for example, employs spectacles of tourmaline so cut as to block that portion of the light having the polarization which causes it to be reflected, thus eliminating glare.

The basic idea on which the appellant relies for patentability is simply that of placing the polarizer of Lowndes between the light source and the object instead of between the object and the eye of the observer. By doing this he obtains no new result whatever. The matter is simply one of convenience in locating the polarizer.

The light emanating from the source may be considered as made up of two parts, one having such polarization that it will be reflected from the object, while the other part will not be. Under ordinary conditions these two parts proceed together to the object, where one is reflected, producing glare and the other is diffused to transmit the image of the object, and the two then continue their passage to the eye of the observer. Glare may be avoided by eliminating the correspondingly polarized light at any point between the light source and the eye, and the particular point at which this is done is merely a matter of choice.

A situation closely analogous to the present one is that involving colored light. Ordinary white light, such as sunlight or electric light, is made up of lights of various colors. If this light is passed through rose-colored glass, for example, light of this color passes through while other colors do not. Accordingly, one who desires to view objects in a rose-colored light may do so by placing such a glass anywhere between the light source and his eye. If the light source is artificial, such as an electric bulb, the simplest and most common practice is to color the glass of the bulb. On the other hand, if the light source is the sun, which cannot be so covered, the practice is to place the glass adjacent the eye, as in spectacles. Both procedures are common and obvious, and it would scarcely be contended that one involved invention over the other. So, in the present case, where Lowndes shows the use of the polarizer in the form of spectacles, it would be equally obvious that it could be placed next to the light source if this source were an electric bulb or similar device. The question is simply whether one or the other is cheaper or more convenient, and this, of course, does not involve invention.

Not only would it be obvious that a polarizer placed between the light source and an object will eliminate the glare due to reflection; but this fact is specifically stated, as follows, by Preston (32):

> Hence, the two-sidedness of the light which has passed through a tourmaline plate (polarizer) may be detected by allowing it to fall upon a plane glass plate. By turning the plate round the beam the reflected light is seen to vary in intensity, and *in one position of the plate the reflected light vanishes altogether.* [Italics added.]

For the reasons given it is thought to be clear that the concept of eliminating glare by placing a polarizer near the light source so that the light will pass through it before reaching objects to be viewed is both old and obvious.

The appealed claims also contain limitations as to the angle at which the light strikes the object. In two of the claims this angle is said to be "about thirty-three degrees," and in the other two "from twenty degrees to seventy degrees." This angle obviously is not critical, as is apparent from the wide permissible range of fifty degrees. Further, there is nothing of record to show any unexpected, or even expected, superiority of the angle claimed to other angles. It is, of course, common knowledge that the angle at which light strikes an object is an important factor in the amount of glare or reflected light. Thus, glare may usually be avoided either by tilting the glass or by the observer's moving his head slightly, the effect in either case being to change the angle at which the light reaching the observer strikes the glass.

The principle just discussed is clearly recognized by Preston who states (34):

> When light is reflected from glass, the reflected beam in general is only partially polarized. It cannot be completely extinguished by a tourmaline plate or by reflection from another mirror at any incidence. *The amount of polarization depends upon the angle of incidence* and, at one particular angle the polarization becomes complete. [Italics added.]

Under these circumstances it seems clear that the idea of avoiding glare by selecting the angle at which the light strikes the object is not a patentable one. It is common practice to place a reading lamp in such a position as to reduce glare. The exact position will be determined by experiment, and this is all that has been done by the appellant. There is no reason why he should be permitted to exclude others from making a similar determination, especially since he has not shown that any particular angle is critical and since his claims indicate that a range of from twenty to seventy degrees, which covers the greater part of the range at which it is possible for light to strike an object, and an even greater proportion of the range customarily employed, is suitable.

For the reason given, it is submitted that all the appealed claims are unpatentable over Lowndes or Lees. The appellant has merely placed the polarizer, which these witnesses prefer to place next the eye, near the light source, a position which is obvious and which is expressly suggested by Preston; and has then selected what he considers the most effective range of angles at which the light may strike the object, the angles thus selected being among those commonly used.

As a second and distinct ground of rejection, it is submitted that the claims find a complete anticipation, in words, if not in spirit, also, in the patent to Short, Fig. 9 of this patent being especially relied on. The trial court found, in its fourth finding of fact (4) that this figure shows a street lamp, some of whose rays are directed toward the ground at an angle of approximately sixty degrees, and a polarizer betwen the lamp and the ground which polarizes the light in substantially the same manner as the appellant's polarizer. This finding is clearly correct and does not appear to be controverted by the appellant.

It will be seen that claims 1 and 68 are directly met in Short. A beam of light is transmitted from the lamp to the ground at an angle of about sixty degrees, which is between the twenty and seventy degree limits specified by these claims. This light is polarized in a manner which the lower court has found to be substantially the same as that employed by the appellant and which must therefore satisfy the requirements of the claims as to polarization. The light will, of course, be diffusedly reflected from the ground. This fully satisfies claim 68. Claim 1 states that the object is viewed without the insertion of a polarizer between it and the eye. While Short suggests the use of such polarizers, it is obvious that, if his system were installed in a city, many persons would view it without the aid of such a polarizer, which would fully satisfy claim 1. Certainly the appellant should not be allowed a claim which would preclude any inhabitant of a city illuminated by the Short system from removing, or failing to purchase, polarized spectacles.

The appellant seems to suggest that Short's system cannot eliminate glare unless a second polarizer is used. The answer to this is that Short polarizes the light in the same manner as appellant and directs it to the object at an angle within the limit claimed. If this does not eliminate glare then the claims do not properly define the appellant's idea. He is not entitled to a claim which will read on Short's disclosure merely because, for reasons not brought out in the claim, he gets a better result.

Claims 3 and 65 specify the angle of the light as "about thirty-three degrees." This is a common angle for directing light on an object and, as already explained, is not shown to be in any way critical here. These claims, therefore, do not differ materially from claims 1 and 68. Further, it is reasonable to suppose that some of the objects which would normally be illuminated by a lamp such as that of Short would be so positioned that the light would strike them at the angle specified, thus fully anticipating claims 3 and 65 as well as claims 1 and 68.

CONCLUSION

It is submitted that the appealed claims are unpatentable first because they cover nothing more than an obvious adaptation of the glare-preventing idea of Lowndes, Preston or Lee, and secondly because they are literally anticipated by the Short patent. The action of the lower court in dismissing the complaint was therefore proper.

Respectfully submitted.

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Solicitor, United States Patent Office.

E. L. Reynolds,
Of Counsel.

U. S. GOVERNMENT PRINTING OFFICE: 1944